

FEASIBILITY STUDY
ON
WATER QUALITY AND SEDIMENTATION
IN
FLINT LAKE
PORTER COUNTY, INDIANA

VALPARAISO LAKES AREA CONSERVANCY DISTRICT
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Valparaiso, Indiana 46383

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EXECUTIVE SUMMARY

Flint Lake is in Porter County located downstream from a series of morainic lakes and many acres of wetlands. The natural watershed for the lake is relatively small with a ratio of approximately 4 acres of watershed to 1 acre of water. However, storm water runoff from other watersheds has been diverted to Flint Lake bringing the ratio to approximately 5 acres of watershed to 1 acre of water.

Flint Lake is primarily dependent upon storm water runoff for its water supply. As such, the level of water in the lake is highly susceptible to the climatic conditions in the area. These fluctuations are less pronounced since the watershed diversions have been accomplished. Also, accelerated development and building in the area has caused increased runoff which has helped to maintain the lake level at a higher elevation. This has improved the function of the lake for boating and related recreational purposes but has also generated concerns with respect to more frequent flooding and an increase in the amount of sediment and/or nutrients being carried into the lake. Cores taken of the lake bottom and tests of the water performed during this study show that excessive sedimentation and nutrients are currently not problems in Flint Lake. This is due to the fact that the lake is rather well protected. Water flowing in each of the tributaries from the overall watershed passes through an adjoining lake, pond or wetland before entering Flint Lake. These bodies of water are acting as sediment and nutrient traps, thereby providing a filtering effect.

The Valparaiso Lakes Area Conservancy District has recently adopted an Erosion Control Ordinance which stipulates various principles applying to all development activities within the District. Strict enforcement of this ordinance will help to reduce sediment due to erosion being carried into Flint Lake and the adjoining waters. This will extend their period of effectiveness.

The quality of water in Flint Lake has improved over the past 17 years. This is evidenced by low concentrations of nutrients substantiated by tests conducted during this study and also by visible decreased aquatic plant growth.

The Eutrophication Index for Flint Lake has been reduced from a classification of 25 as established in 1972 by the Indiana Department of Environmental Management to a classification of 10 as established in 1989 by Northern Laboratories & Engineering, Inc. This corroborates that the water quality in the lake has improved.

Recommendations for enhancing the water quality in Flint Lake include the following:

1. LEGAL AND GOVERNMENTAL

- A. Preserve the wetlands at the inlets into the lake and throughout the District by adopting and enforcing an ordinance regarding Wetlands Preservation and/or Protection;
- B. Continue to protect the adjoining ponds, lakes and wetlands from excessive sedimentation by controlling erosion from all building sites within the District. This can be accomplished by strictly enforcing the Erosion Control Ordinance adopted by the Board of Directors of the Valparaiso Lakes Area Conservancy District;

- C. Continue to encourage the Plan Commissions and the governing agencies in the City of Valparaiso and Porter County to adopt and enforce Erosion Control Ordinances for the respective areas under their jurisdiction. This will provide assurances that excessive erosion will be controlled in areas outside of the District boundary but still within the overall watershed to Flint Lake;
- D. Continue to encourage the construction of sanitary sewers to serve homes around the upstream lakes and wetlands.

2. THE AREA'S BEST MANAGEMENT PRACTICES

- A. The smallest practical area of land should be exposed at any one time during development;
- B. When land is exposed during development, the exposure should be kept to the shortest practical period of time;
- C. Temporary vegetation and/or mulching should be used as needed to protect critical areas exposed during development;
- D. Sediment/nutrient filter basins should be installed as needed to remove sediment from runoff waters and land undergoing development;
- E. Natural vegetation should be retained and protected as much as possible;
- F. Topsoil should be saved for re-spreading over areas with poor soil quality to facilitate establishing vegetative growth;
- G. The permanent final vegetation should be established and structures installed as soon as practical in the development;
- H. The development plan should be fitted to the topography and soils so as to create the least possible danger from erosion and/or wetness;
- I. Detention reservoirs should be constructed where needed to reduce flooding by detaining surface water runoff and metering this runoff into natural or artificial drains;
- J. Grassed waterways and surface drainage channels should be installed as needed to safely remove ponded and/or excess water;
- K. Drainage channels and interconnecting detention reservoirs should be planned to provide maximum open space and scenic benefits as well as necessary water management benefits;
- L. No construction excavation, deposit, or fill should be placed where it will adversely affect the floodway of a watercourse;
- M. Soils in a floodplain should remain in open space use or be placed into uses for which flooding is not detrimental;

- N. A central sewage system should be made available in all developments that exhibit soils with severe or very severe limitations for septic tanks and soil absorption fields as determined by a Soil Survey by USDA - Soil Conservation Service in cooperation with Purdue University Agriculture Experimental Station (see Indiana State Board of Health S.E. 8).

3. CONSTRUCTION MEASURES

- A. Construct sediment trap(s) at the Southwest inlet into the lake. The traps should be located upstream from the wetlands near the Burlington Beach Road intersections with Claussen Lane and Hippo Lane. The traps would collect grit and other sediment prior to its entrance into the wetlands. Discharges from the structure should be designed to spread the flow in several directions into the wetlands;
- B. Construct control structures, if possible, at both the existing channel and culvert into the lake. These structures would maintain a minimum water level in the wetlands during dry periods. This would allow the wetlands to function to their maximum capability as "filters".

4. MONITORING

- A. Monitor both Flint Lake and selected ponds and lakes upstream from Flint Lake to assure that they remain viable sediment and nutrient traps;

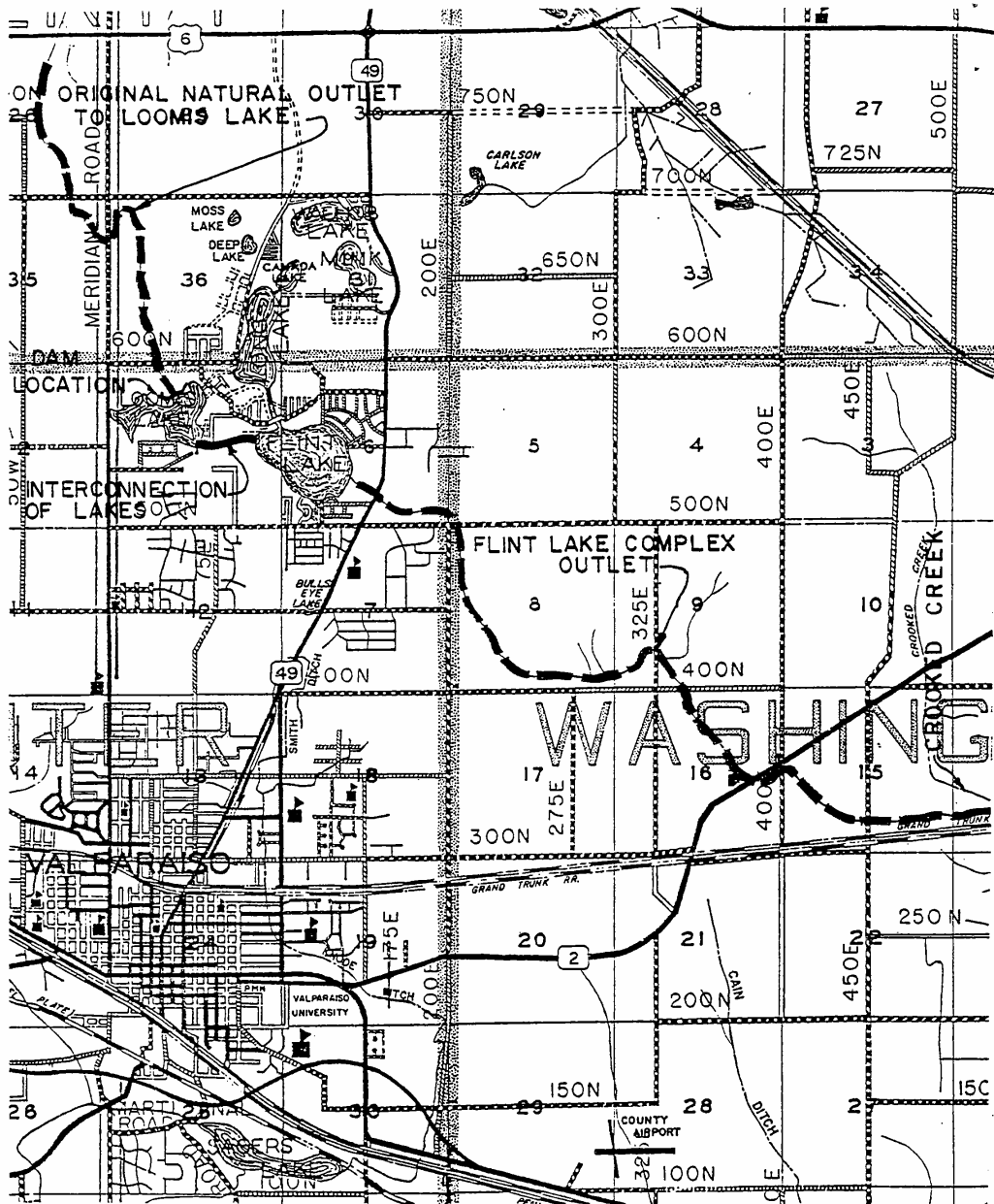
Three suggested monitoring techniques are suggested for each individual station. Exact locations within these water bodies should be located and marked with buoys or carefully referenced from markers on the shore. Then at each location once yearly in July, the following should be read:

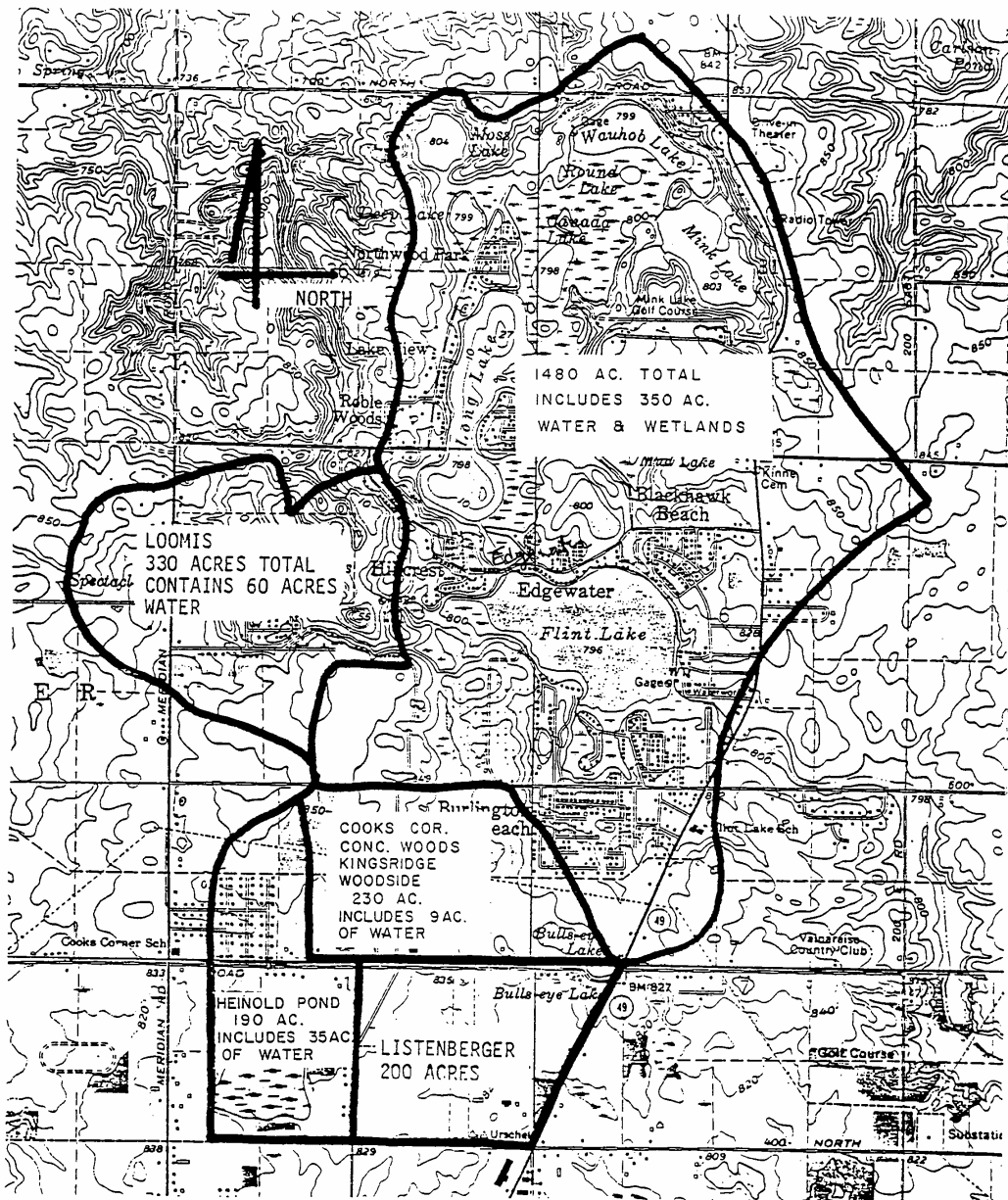
1. Clarity to be determined with a standard Secchi Disc reading;
 2. Aquatic vegetation measured as estimated density and height from water's surface;
 3. Sediments measured as depth from top of permanent marking stake.
- B. Conduct soundings on the lake bottom in the southwest side of the lake at periodic intervals to monitor any increased sedimentation;
- C. Continue to monitor aquatic plant growth in the lake to determine if there is a marked increase.

Flint Lake is a public access lake. There is an existing public boat ramp on the south side of the lake at the north end of Flint Lake Gateway. Construction of other public boat ramps is being considered. Associations owning and maintaining public access points include the Blackhawk Beach Association, the Edgewater Beach Association, the Hillcrest Beach Association, and the Burlington Beach Association. Each of these associations serves citizens living in the Flint Lake area.

Flint Lake has an average depth of 40 feet, covers approximately 95 acres, and is surrounded by high ridges on the north and east. Long Lake covers approximately 60 acres and occupies a narrow valley to the northwest of Flint Lake. Loomis Lake covers approximately 50 acres, is approximately 15 feet higher than Flint and Long Lakes, and is located west of Flint Lake. All of these lakes are of morainic origin and lie very close to the summit of the main crest of the moraine. Other lakes in the immediate vicinity include Spectacle Lake, Deep Lake, Moss Lake, Canada Lake, Round Lake, Wauhob Lake, Mink Lake, and Mud Lake. All of these lakes depend primarily on storm water runoff for their water supply. The natural outlet of Flint and Long Lakes is a branch of Crooked Creek which is a tributary to the Kankakee River (see Plate 2). The natural outlet of Loomis Lake was to Damon Run, a tributary to Salt Creek, which drains to Lake Michigan; however, a dam has been constructed across that outlet and a controlled discharge connection has been made between Loomis and Flint Lakes.

Many of the other lakes are interconnected during periods of average lake level. Long Lake and Flint Lake are connected by a 48 inch diameter corrugated metal pipe with an approximate invert elevation of 796.7. All others are interconnected with the natural topography of the area. These lakes and surrounding wetlands, hereafter referred to as Flint-Long Lake Complex, can be considered one large basin. This natural watershed is relatively small (1,480 acres) compared to water surface (350 acres). Therefore, approximately 4 acres of natural runoff feed each acre of water. A generally accepted rule-of-thumb requires a ratio of 8 to 1 for "contribution area to water surface area" in order to adequately maintain water levels. In the 1920's and 1930's, Flint Lake was the sole source of water supply for the Valparaiso Department of Water Works. For this reason, the Department diverted water from portions of other watersheds so that increased flow could be directed into Flint Lake increasing the availability of water. These diversions included the Loomis Lake Drain and the combined Heinold/Listenberger Drain. In the 1970's, the Cooks Corners-Concord Woods-Kingsridge-Woodside Drain was constructed (see Plate 3). These additional 950 acres of watershed improved the ratio to approximately 5 to 1. This is still below the suggested ratio but is a definite improvement over the natural ratio. A reasonably stable higher lake level is maintained due to this increased ratio as well as increased urban development within the overall watershed. Urban development generally induces a higher volume of runoff due to increased impervious surface. This allows the lake to remain a viable source of water for the Valparaiso Department of Water Works while also sustaining its ability to support recreational activities.





DRAINAGE AREAS

General Factors Affecting Lakes

Many factors influence any lake's existence:

1. Climatological phenomena affect the lake level;
2. Erosion, sedimentation and other processes act to either fill in the basin or drain it;
3. Action of the natural biological process known as eutrophication modifies a lake and eventually transforms it into a bog or swamp;
4. Deliberate actions by man artificially preserve lakes by dredging or damming them. Conversely, acts of drainage can eliminate lakes.

The climate of the region has a pronounced effect upon a lake whose water supply is primarily dependent upon storm water runoff. Periods of cool temperatures with average or above average levels of rainfall will maintain the lake at a high level. Periods of hot temperatures with below average levels of rainfall will maintain the lake at a low level due to evaporation. When either of these conditions are present for long periods of time, the lake can either be at or near flood conditions or at or near dangerously shallow levels.

Sedimentation occurs through the addition of materials washed into the lake or through settling or chemical precipitation from the lake's waters. Silt, sand, clay and other materials wash directly into the lake from surrounding slopes or are deposited by tributary streams. Eroded material, as well as plant and animal remains from the shallow or shore areas, may be redeposited among the deeper sediments. Wind blown material may also settle on the lake surface and sink to the bottom. Within the lake itself, bodies of floating organisms sink gradually to the bottom, as do remains of algae and other vegetation.

Eutrophication is a natural aging process by which a lake or pond becomes increasingly productive of plant life. The chief cause of eutrophication is an increase in the supply of plant nutrients such as nitrogen and phosphorus through erosion or drainage. These nutrients when out of their natural balance support the growth of enormous amounts of algae and aquatic plants, which in turn provide food for fish and other water organisms. When these organisms die, their bodies accumulate in the bottom of the lake along with sediment already deposited. The decomposition of these organisms decreases the level of dissolved oxygen in the water, and eventually the lake fills to extinction. Small lakes with large fertile drainage basins are usually shallower, more productive, and generally become eutrophic faster than lakes whose drainage basins are smaller in proportion to the surface area of the lakes.

Human activities often alter the natural state of a lake and have an effect upon the rate of eutrophication. Raw and treated sewage effluent, industrial wastes, erosion from agricultural lands, and fertilizers that wash into the lakes from agricultural lands and developed landscapes all add nutrients to the lake.

Study Objectives

The purposes of this study are to determine the quality of the water in Flint Lake as it exists today compared to its quality in the past and to determine the extent of sedimentation in the lake. This will provide the Board of Directors the information necessary to initiate programs within the District to protect the lake from future deterioration. Included in the study are:

1. a review of historical data to determine the trend of water quality and water levels in the lake;
2. the sampling of lake water at various point sources to determine the quality of runoff;
3. the determination of the current Eutrophication Index;
4. the determination of the elevation of the lake bottom in the southwest portion and the search for any evidence of sedimentation;
5. an analysis of the overall watershed to determine land use, growth and runoff.

HISTORICAL DATA

Valparaiso Lakes Area Conservancy District

In 1974, a group of citizens in the Flint Lake area met to discuss their concern for the future of Flint Lake. They felt that the lake was being abused and unless steps were taken, the lake would deteriorate at an ever increasing rate. In their minds, this abuse included 1) allowing effluent from malfunctioning septic systems to be discharged into the lake and 2) allowing runoff water laden with sediment and nutrients to flow into the lake from various point sources. As individual citizens there was very little that could be accomplished to rectify this situation. After many discussions with governmental officials from Porter County and the City of Valparaiso, little interest was found to help the area. Therefore, the Valparaiso Lakes Area Conservancy District was formed to address these concerns on a local level. The Conservancy District was established by the Circuit Court of Porter County and is governed by its own Board of Directors made up of citizens living in the District. One of the goals of this Board was to save Flint Lake and its environs by accomplishing the following:

1. Establishment of a viable source of potable water and the construction of a reliable distribution system so that the area would continue to grow and prosper;
2. Construction of sanitary sewers to collect the wastes from the houses in the area and to conduct the wastes to a reliable treatment facility;
3. Establishment of an acceptable lake level so that areas adjacent to the lake are not periodically flooded and yet provide sufficient water in the lake to provide for quality recreational activities;
4. Establishment of a plan to control the amount of sediment being carried into the lake at the various inlet points;

A more detailed summary of each of these items follows.

1. Potable Water Source and Distribution

Prior to the establishment of the Valparaiso Lakes Area Conservancy District, the area was served with potable water by a utility company on the verge of bankruptcy. The water was purchased from the Valparaiso Department of Water Works and distributed by 1" to 2-1/2" galvanized water mains which were very old and contained many leaks. The utility company was badly managed and consequently could not meet its payments to the Valparaiso Department of Water Works for the water being purchased. An improved water distribution system run by a well managed company is important for the general welfare of the community. This helps increase assessed valuation to provide tax dollars for funding proper lake management. The utility company was taken over by the District in 1975, renamed LAC Utilities, and periodic improvements were made to the system. This was made possible by the cooperation of the Valparaiso Department of Water Works and funding assistance from the Indiana Department of Natural Resources.

The majority of the distribution system is now in excellent condition, and improvements are being made annually on those areas which still contain some small galvanized pipes. Water is being purchased from the Valparaiso Department of Water Works through four major metering points. These improvements along with the installation of sanitary sewers has allowed for continued growth in the area.

2. Sanitary Sewers and Sewage Treatment

Once the water distribution system was improved, the Board of Directors of the District turned its attention to the construction of a sanitary sewer collection system and a method of treating wastes collected within the District. With the assistance of funding from the U. S. Environmental Protection Agency, the State of Indiana, the Department of Housing and Urban Development and with funds generated within the District, a complete sanitary sewer collection system serving all of the properties in the District was constructed. The Board in its wisdom purchased sufficient capacity in the City of Valparaiso's treatment system to allow for the treatment of wastes from the existing homes in the District as well as from homes in future developments which could take place in the immediate lake area. Growth began with the improvement of Kingsridge North containing approximately 95 homes and with Ridgewood Creek containing approximately 140 living units in single family residences and condominiums. Another subdivision containing 65 homes is in the process of being developed and two other subdivisions containing a total of approximately 60 living units are under consideration by local developers.

3. Acceptable Lake Level

The Board of Directors has long been concerned about the level of the water in Flint Lake. The source of water for the lake is primarily runoff from the overall watershed. In times of drought, the lake becomes very low and in periods of high rainfall, the lake level rises (see Plate 4). To control this fluctuation, the Board has been actively pursuing a program to improve the outlet from Flint Lake. At present, the outlet consists of two 24" x 36" corrugated metal pipe arches under a private road on the East side of the lake. These culverts are maintained by the Valparaiso Water Department and create an artificial "normal average" water level of about 799.25. This elevation is 1.59 feet above the court established legal lake level of 797.66. Studies have been done by PTGR, Inc. (the Board's Consultant), the Indiana Department of Natural Resources, and the Porter County Drainage Board to determine various alternatives of improving the outlet. All of the studies have shown that the level can be controlled and the periodic flooding condition alleviated if the average normal water level in the lake could be lowered by 0.75' to 1.0' and if the outlet from the lake were improved to be able to carry a greater rate of flow.

The lowering of the normal lake level would help to alleviate flooding conditions, but it would also reduce the volume of water stored above the legal level for the lake. A reduced amount of storage is unacceptable to the Valparaiso Department of Water Works as the lake is important to their water supply. The Court Order states that water cannot be drawn from the lake once the legal level is reached unless an equal amount is put back into the lake. The Valparaiso Department of Water Works draws water from the lake to be processed as potable water, and when the legal level is reached, the Department pumps water back into the lake from adjacent wells. This procedure is used because lake water is easier to process into good quality potable water than well water due to the high iron content in the latter.

Lowering the normal lake level could also be detrimental to existing wetlands adjacent to and upstream from the lake as normal water levels in those areas might also be lowered.

Negotiations between the Valparaiso Lakes Area Conservancy District Board of Directors, the Department of Water Works and the Indiana Department of Natural Resources concerning the outlet have occurred in the past but are not currently on-going. Those negotiations were not successful in finding a solution to this lake level dilemma.

FLINT LAKE LEVEL

(Information from Valparaiso Water Department)

Court Determined Level = 797.66

<u>Year</u>	<u>High</u>	<u>Low</u>
1911	792.72	788.87
1912	797.38	789.07
1913	796.97	791.97
1914	794.55	790.80
1915	792.97	789.38
1916	796.55	791.47
1917	795.3	787.84
1918	794.47	787.02
1919	798.17	789.35
1920	797.43	789.22
1921	797.67	790.22
1922	798.05	788.79
1923	798.35	787.72
1924	799.95	796.99
1925	798.2	793.05
1926	799.09	795.59
1927	800.2	797.8
1928	799.81	795.28
1929	800.12	796.28
1930	799.29	791.32
1931	792.45	789.54
1932	797.54	792.38
1933	800.2	796.57
1934	797.34	793.09
1935	799.82	793.06
1936	798.38	791.9
1937	797.49	791.27
1938	799.07	790.48
1939	799.68	796.15
1940	798.58	793.47
1941	799.25	793.18
1942	800.4	796.32
1943	800.4	797.09
1944	800.21	795.68
1945	799.46	795.41

<u>Year</u>	<u>High</u>	<u>Low</u>
1946	800.18	796.19
1947	800.26	794.58
1948	799.86	792.82
1949	797.74	792.45
1950	800.8	796.58
1951	800.2	797.07
1952	800.41	796.2
1953	798.29	794.1
1954	799.64	793.94
1955	799.8	797.08
1956	799.73	795.83
1957	798.75	795.7
1958	798.37	794.67
1959	799.98	794.34
1960	799.97	794.19
1961	799.35	794.55
1962	798.46	793.41
1963	796.21	793.24
1964	797.58	792.9
1965	799.22	793.26
1966	799.96	797.64
1967	800.03	797.42
1968	800.05	796.54
1969	799.78	796.07
1970	800.05	795.51
1971	798.85	797.58
1972	800.25	797.81
1973	801.04	797.66
1974	800.15	797.27
1975	800.50	797.75
1976	800.86	797.17
1977	798.98	796.08
1978	800.19	796.43
1979	800.55	796.90
1980	799.70	797.40
1981	801.30	797.94
1982	800.86	797.07
1983	801.15	798.09
1984	800.92	798.45
1985	800.63	797.75
1986	800.73	798.04
1987	800.02	798.41
1988	800.26	795.48
1989	800.54	797.20
1990	800.90	797.02
1991 (to date)	800.25	799.46

4. Sedimentation Control

The Board of Directors has also been concerned about controlling the amount of sediment being carried into Flint Lake.

In late 1987 and early 1988, the Board of Directors of the Valparaiso Lakes Area Conservancy District determined that if an erosion control plan was to be implemented, they would have to be the governmental body taking the action. After reviewing several documents used in other areas, the Board adopted an Ordinance Providing for the Control of Soil Erosion and Sedimentation from Areas Undergoing Development in the Valparaiso Lakes Area Conservancy District (see Exhibit 2 - Ordinance 88-1) and has adopted a set of standards and requirements titled "Procedures and Standards for Urban Soil Erosion and Sedimentation Control". These were patterned after a like document used by the Northeastern Illinois Soil Erosion and Sedimentation Control Steering Committee.

This Erosion Control Ordinance stipulates various principles which apply to all development activities within the District. These include requiring the installation and maintenance of sediment basins, debris basins, desilting basins, silt traps, or silt filters to remove sediment from runoff waters from land undergoing development. The officials of the City of Valparaiso and Porter County were encouraged to adopt similar ordinances so that all of the land within the overall watershed is subject to uniform standards and control practices. The Porter County Plan Commission has adopted an Erosion Control Ordinance for all lands within the District. However, they have chosen not to include all the unincorporated lands within the overall watershed even though the Board of Directors of the Valparaiso Lakes Area Conservancy District had strongly recommended its inclusion. The City of Valparaiso has also just recently enacted an Erosion Control Ordinance.

Prior Study Attempts Within the Watershed

In 1981, a comprehensive study was proposed on the overall watershed by the Northwestern Indiana Regional Planning Commission (NIRPC) in an attempt to establish a Valparaiso Lakes Area Land Use Management Study (see Plates 5 and 6). An extensive Ad Hoc Committee was formed made up of governmental leaders from the City of Valparaiso, Porter County, Valparaiso Lakes Area Conservancy District, Valparaiso Park and Recreation Board, Lake Associations and interested citizens to gather data, substantiate problems, and recommend solutions. The committee proved to be very cumbersome, and the plan of moving ahead with recommended solutions for cleaning up the chain of lakes was not implemented. Federal funding was not forthcoming and the whole idea of a cooperative effort to better the quality of water in the lakes was abandoned.

However, NIRPC did prepare theoretical models of Flint, Loomis and Spectacle Lakes using the Rational Method and the Universal Soil Loss Equation (see Tables I and II). These models showed that phosphorus could be controlled by land management practices. Table III showed that sedimentation could be greatly reduced with the use of a Sedimentation and Erosion Control Plan.



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VALPARAISO LAKES LAND USE MANAGEMENT STUDY

NOVEMBER 1981

To protect the quality and longevity of Flint, Spectacle, Loomis and other lakes in the Valparaiso area, the Northwestern Indiana Regional Planning Commission (NIRPC) has conducted a study to predict the loss of soil sediment and phosphorus from land uses in the areas surrounding the lakes. Using a mathematical model, the water quality of the lakes can be predicted, as well as the long-term effects upon the lakes of pollution and uncontrolled development. Using data collected during the study, a land use management plan has been developed to control land use practices which can adversely affect the Valparaiso area lakes.

As a resident of Valparaiso or a surrounding community, you are invited to review and comment upon the proposed land use management plan, at a public meeting which will be held Friday, December 11, 1981 at 7:30 p.m. in the Community Meeting Room at Citizen's Federal Savings & Loan Building, Heritage Valley, Route 30 West, Valparaiso.

Your comments, and those of other area residents, concerning land use problems and proposed solutions, will be incorporated into the land use management plan, to be presented to the Porter County Council as a proposed land use ordinance. You will receive a newsletter in late December summarizing the information gathered during the study, reporting the public's response at the meeting, and highlighting provisions of the proposed land use ordinance.

For further information about the project or the December 11 meeting, contact: Ewa Shannon, Northwestern Indiana Regional Planning Commission, 8149 Kennedy Avenue, Highland, Indiana 47322 - (219) 923-1060.



**NORTHWESTERN INDIANA
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A Cooperative Of Local Governments

VALPARAISO LAKES LAND USE MANAGEMENT STUDY

March 1982

With the assistance of residents of Valparaiso and surrounding communities, the Northwestern Indiana Regional Planning Commission (NIRPC) has developed a land use management plan to control land use practices which can adversely affect Valparaiso area lakes, including Flint, Loomis and Spectacle Lakes. This plan was developed following a study by NIRPC which used mathematical models to predict the loss of soil sediment and phosphorus in the areas surrounding the lakes.

Sediment and nutrients (i.e., phosphorus) are the primary causes of degradation in lakes surrounded by areas undergoing development and construction. Effective controls must be adopted, therefore, to reduce the adverse impact of pollution and uncontrolled development. The land use management plan proposed by NIRPC recommends such controls.

The plan was presented to interested citizens at a public meeting held December 29, 1981 at the Valparaiso City Hall. Comments of the meeting attendees were incorporated into the final plan which was presented to the Porter County Board of County Commissioners as a proposed ordinance to control soil erosion, sedimentation and other pollutants in areas undergoing development within the Flint, Loomis and Spectacle Lakes watershed. The proposed ordinance is presently pending before the Board of County Commissioners.

The highlights of the proposed land use ordinance are summarized below:

General Principles for all Land Disturbance Activities

- Natural contours of the land should be followed and development should relate to the topography and soils of the site so as to create the least potential for erosion.
- Natural vegetation should be retained and protected.

- Natural watercourses should be left undisturbed.
- The smallest practical area of land should be exposed for the shortest practical time during development.
- Basins, silt traps or filters should be used to remove sediment from runoff waters in land undergoing development.
- Provisions should be made to accommodate increased runoff during and after development.
- Permanent vegetation and structures should be installed as soon as possible during development.

Site Development Permit

- No grading, stripping, excavating or filling of land shall be allowed unless a site development permit is first obtained from the Porter County Plan Commission.
- However, a permit shall not be required for agricultural or gardening uses of land, or for installing, renovating or replacing a septic system for an existing structure, or for excavation for basement and footings of a single-family residence on a site larger than five acres.
- An application for a site development permit shall include a vicinity map, a development plan of the site, an erosion and sedimentation control plan, and a statement of the proposed phasing of development of the site.
- For applicants who plan the intensive development of single-family dwellings, multi-family dwellings and or commercial or industrial facilities on sites greater than ten acres, a retention basin shall be constructed for retaining storm water generated from a five year, one hour intensity storm.
- An applicant for a site development permit shall also submit a performance bond or letter of credit as security to cover all costs of improvements and landscaping as well as engineering and inspection costs.
- The Porter County Plan Commission shall take action on any permit application within 30 days after it is submitted to the Commission, and an applicant may appeal a decision of the Plan Commission to the Porter County Board of Zoning Appeals.

It is recommended that the Porter County Board of County Commissioners adopt the proposed ordinance so that the aesthetic appeal and recreational use of the Valparaiso area lakes may be enhanced and preserved for future generations.

For further information about the project or the proposed land use ordinance, contact: Ewa Shannon, Northwestern Indiana Regional Planning Commission, 8149 Kennedy Avenue, Highland, Indiana 46322, (219) 923-1060.

TABLE I

Modeling of Flint, Loomis and Spectacle Lakes using the Rational Method

	<u>Phosphorus Concentration, mg/l</u>	
	<u>Flint Lake</u>	<u>Loomis and Spectacle Lakes</u>
Permissible Phosphorus Concentration	.125	.049
Existing Phosphorus Concentration	.109	.066
Development of Vacant Land Into Single Family Residential	.83	.092
	(59% Increase)	(71 % Increase)

TABLE II

Modeling of Flint, Loomis and Spectacle Lakes
using the Universal Soil Loss Equation

	<u>Phosphorus Concentration, mg/l</u>	
	<u>Flint Lake</u>	<u>Loomis and Spectacle Lakes</u>
Permissible Phosphorus Concentration	.125	.049
Existing Phosphorus Concentration	.219	.188
 <u>BEST MANAGEMENT PRACTICES</u>		
1. Seeding, Fertilizing and Mulching of Construction Areas (no time interval between seeding and building)	.189 (14% Reduction)	.177 (6% Reduction)
2. Seeding, Fertilizing and Mulching of Construction Areas (6 months between seeding and building)	.175 (20% Reduction)	.172 (8% Reduction)
3. Small Retention Basin in Construction Areas (100% catchment) with 1 above	.161 (26% Reduction)	.167 (11% Reduction)
4. Small Retention Basin in Construction Areas (100% catchment) with 2 above	.157 (28% Reduction)	.165 (12% Reduction)
5. Minimum Tillage with 2000-3000 lbs. Residue in Cropland, with 4 above in Vacant Land	.123 (43% Reduction)	.071 (62% Reduction)

TABLE III

Runoff Control Methods that may be incorporated
into a Sedimentation and Erosion Control Plan

<u>Control Method</u>	<u>Functions</u>
Selective Grading and Shaping	Reduces critical slope lengths and gradients, thus slowing runoff.
Vegetative Buffer Strips	Slows runoff velocity, thus filtering sediment from runoff. Reduces volume of runoff by increasing surface ponding.
Roughened Surface	Reduces velocity while increasing infiltration rates. Collects sediment and holds water.
Benches	Reduces runoff velocities by decreasing effective slope lengths. Retains some sediment. Provides access to slopes for revegetation.
Diversion Structures	Collects and directs water from vulnerable areas to prepared drainageways and so reduces erosion potential.
Grade Control Structures	Slows velocity of flow, reducing erosive capacity. Usually permanent.
Grassed Waterways	Grass tends to filter sediment and slow runoff and so stabilizes drainageways.
Level Spreader	Collects channel or pipe flow and converts it to sheet flow. Increases deposition.
Seeding, Fertilizing and Mulching	Establishes vegetation on cleared areas.
Retention Basin	Collects runoff and allows sedimentation of suspended solids.

Another attempt to organize and implement a land management plan was made by the local office of the U. S. Soil Conservation Service (USCS). Applicable standards widely used by the USCS were compiled for this watershed but were never adopted by the necessary governmental bodies.

Porter County Health Department

The Porter County Health Department has had a continuing program for monitoring the quality of water at two beaches on Flint Lake: 1) Burlington Beach on the south side of the lake and 2) Edgewater Beach on the north side of the lake. A comparison of a four year period prior to the installation of sanitary sewers (1979-1982) and a four year period after the installation of sanitary sewers (1985 and 1987-1989) shows a reduction in the times when the fecal coliform counts exceeded 200/mL. This is the level which is considered the limit for safe whole body contact. The results of the tests for this eight year period follow:

FECAL COLIFORM COUNTS FOR
WATER SAMPLES TAKEN FROM FLINT LAKE
PRIOR TO INSTALLATION OF SANITARY SEWERS
IN THE VALPARAISO LAKES AREA CONSERVANCY DISTRICT
PORTER COUNTY HEALTH DEPARTMENT

1979

Date	06/11	06/20	06/27	07/10	07/17	07/24	07/31	08/06	08/28	09/05
Edgewater Beach	10	60	0	<10	10	10	10	180	0	60
Burlington Beach	10	850	60	<10	80	30	50	--	--	30

1980

Date	06/09	06/18	06/23	06/30	07/07	07/14	08/06	08/13
Edgewater Beach	20	20	0	0	310	120	10	160
Burlington Beach	60	320	20	510	50	270	70	60

1981

Date	06/02	06/11	06/17	06/23	07/01	07/07	07/21	07/27	08/05	08/11
Edgewater Beach	450	10	100	10	40	150	40	120	20	10
Burlington Beach	580	70	3300	--	--	200	90	170	--	<10

1982

Date	06/23	06/30	07/06	07/13	07/20	07/26	08/03	08/09	08/16	08/23
Edgewater Beach	<10	10	70	<10	20	50	<10	<10	10	<10
Burlington Beach	<10	10	370	10	<10	10	10	<10	<10	<10

FECAL COLIFORM COUNTS FOR
WATER SAMPLES TAKEN FROM FLINT LAKE
AFTER THE INSTALLATION OF SANITARY SEWERS
IN THE VALPARAISO LAKES AREA CONSERVANCY DISTRICT
PORTER COUNTY HEALTH DEPARTMENT

1985

Date	06/03	06/17	07/25	08/07
Edgewater Beach	0	0	130	100
Burlington Beach	150	100	210	100

1986 - Limited Results Available

1987

Date	06/10	06/17	06/24	07/01	07/06	07/14	07/20	07/28	08/03	08/10
Edgewater Beach	30	<10	10	<10	10	70	<10	10	<10	20
Burlington Beach	<10	30	120	70	--	170	80	<10	50	20

1988

Date	05/31	06/28	07/05	07/12	08/02	08/10	08/22	08/30
Edgewater Beach	50	10	<10	10	<10	<10	<10	<10
Burlington Beach	90	20	10	40	<10	100	10	<10

1989

Date	06/06	06/13	06/20	06/27	07/11	07/18	08/01	08/16	08/23	09/08
Edgewater Beach	<10	207	--	--	10	10	1750	0	--	20
Burlington Beach	40	<10	<10	40	<10	<10	2000	12	50	30

The four year period 1979-1982 when no sanitary sewers were in operation saw Fecal Coliform counts exceeding the "Safe for Body Contact" level each year at least one time.

The four year period 1985-1989 when sanitary sewers were installed shows dramatic reduction in Fecal Coliform counts. Only twice during this entire period were counts at unacceptable limits. One of these occurrences was due to a sewer line malfunction.

A logical assumption can also be taken from these counts that Phosphorus and Nitrogen levels should have dropped proportionately.

Aquatic Plant Survey

A study of the aquatic plant growth in Flint Lake was last performed in 1986 by the Indiana Department of Natural Resources (IDNR). Data from that study was obtained from Mr. Bob Robertson, Fisheries Biologist at IDNR (see Plate 7 - Flint Lake Common Species of Aquatic Plants). It showed that approximately 20% of the lake was covered with Spatterdock while other common emergent plants were present in the range of 2 to 5 percent.

According to reports from residents in the area, the findings of the 1986 study reflect a marked decrease in the amount of weed/vegetation growth in the lake from the conditions that existed in the 1960's and 1970's. This change could be taken to indicate that the concentrations of nitrogen and phosphorus in the lake have also decreased. Recent water tests, while giving no data on levels 20 to 30 years ago, show that at present the nitrogen and phosphorus levels are below accepted limits. These tests are discussed later in this report.

Flint Lake

19. COMMON SPECIES OF AQUATIC PLANTS

COMMON NAME	SCIENTIFIC NAME	DEPTH FOUND	PER CENT COVERED
Emergent:			
Spatterdock	Nuphar advena	3'	20%
White waterlily	Nymphae tuberosa	3'	5%
Common arrowhead	Sagittaria latifolia	2'	2%
American bulrush	Scirpus americanus	2'	2%
Water purslane	Ludwigia palustris	2'	2%
Common cattail	Typha latifolia	2'	2%
Submergent:			
Green watermilfoil	Myriophyllum verticillatum		
Curlyleaf pondweed	Potamogeton crispus	12'	
Largeleaf pondweed	P. amplifolius	10'	
Sago pondweed	P. pectinatus	10'	
Small pondweed	P. pusillus	10'	
Flatleaf pondweed	P. robbinsii		
Coontail	Ceratophyllum demersum		
Algae:			
Chara	Chara spp.	8'	

Comments

Since Flint Lake is a municipal water supply, only copper sulfate can be used to control aquatic vegetation. Copper sulfate only controls algae which is not a problem at present.

FLINT LAKE WATERSHED

General Data on the Watershed

The overall watershed of Flint Lake consists of an area within the northern portion of Valparaiso and an area lying north of the north Valparaiso corporate limits. This watershed covers approximately four square miles and encompasses a chain of eleven lakes, several small ponds, wetlands, commercial developments, residential developments and some limited agricultural land. The Valparaiso Lakes Area Conservancy District covers a portion of the overall watershed. Flint Lake is the only lake fully located within the District. Portions of Loomis Lake, Long Lake, several of the small ponds, and some of the wetlands are also located within the District.

Major Drains Affecting Flint Lake

Four major point sources feeding Flint Lake have been of major concern to the Board (see Exhibit 3 - Watershed Map). These include the combined Heinold/Listenberger Drain, the Loomis Lake Drain, the Cooks Corners-Concord Woods-Kingsridge-Woodside Storm Drain, and the Long Lake-Flint Lake Connecting Drain. The water from these drains represents the major source of water for Flint Lake.

The combined Heinold/Listenberger Drain conducts runoff from approximately 390 acres of land, most of which is located in the City of Valparaiso. The runoff includes surface drainage from a major commercial development, a large parking lot serving a major retail complex, a nursing home, several residential streets, and an area being farmed. Fortunately, during heavy rain storms this runoff is controlled in three detention basins which are also acting as sediment traps. However, there has still been concern about a certain amount of sediment as well as pollutants such as oil and grease, chemicals, and fertilizers being carried into Flint Lake.

The Loomis Lake Drain conducts runoff from approximately 330 acres of land, a portion of which is located in the City of Valparaiso. This runoff, which includes the surface drainage from a major residential development, is controlled in Spectacle and Loomis Lakes which are also acting as sediment traps. Once again, the Board has been concerned about pollutants such as oil and grease, chemicals and fertilizers being carried into Flint Lake during periods of heavy rainfall.

The Cooks Corners-Concord Woods-Kingsridge-Woodside Storm Drain conducts runoff from approximately 230 acres. The runoff from this area includes the surface drainage from several major residential developments. No intermediate sediment ponds are located in this area, so the runoff is controlled only by a wetland. The Board has been concerned that sediment and fertilizers were being carried into Flint Lake from this drain.

The Long Lake-Flint Lake Connecting Drain carries runoff from the area surrounding Long Lake, Wauhob Lake, and Mink Lake. The homes in these areas are still being served with on-site septic systems. The Board has been concerned about Long Lake being polluted by effluent from malfunctioning septic systems which would subsequently be carried into Flint Lake.

Soil Type Identification Within the Watershed

Soils within the Flint Lake Watershed are generally very unsuitable for development. According to the Soil Conservation Service mapping (see Plates 8 and 9), over 90% of the surface area lies on "Highly Erodible Lands". The vast majority of the remaining surface area is classified as water areas or Hydric soils. This combination of "Highly Erodible Lands" and Hydric lands presents some very serious development problems. Only by using extreme care should development be allowed on these sites.

Wetlands

There are numerous wetlands within the overall watershed. These are shown on Exhibit 4 - Wetland Classification. This exhibit is a portion of the Chesterton Quad of the National Wetlands Inventory Map as prepared by the U. S. Fish and Wildlife Service in 1979. As can be seen on this exhibit, approximately 50% of the land surrounding the lakes within this watershed is classified as wetlands.

All of these wetlands play a major role in buffering the rates of runoff from this watershed and aid in removing sediment and pollutants from the waters. Runoff from the overall watershed flows through one or more of these wetlands prior to entering Flint Lake. These wetlands are vital to the lake and must be preserved. Should an excess of sediment from the runoff be deposited in the wetlands, it could render them useless for this purpose. Every means must be used to control and trap this sediment before it reaches the wetlands.

Land Use, Zoning and Future Growth

Construction and development within that portion of the overall watershed in the City of Valparaiso are regulated by the Valparaiso Plan Commission. The Porter County Plan Commission regulates construction outside of the Valparaiso corporate limits. Any development proposed to occur within the boundaries of the Valparaiso Lakes Area Conservancy District must also be reviewed by the governing Board of that entity.

The majority of the land within this watershed is zoned for single family residential use (see Exhibit 5 - Current Zoning). This zoning allows for an average lot size if the site is served with sanitary sewers and a public water supply. In the unincorporated areas of this watershed, only the lands within the Valparaiso Lakes Area Conservancy District have these utilities available. Sites outside of the District and/or outside of the City of Valparaiso are served with individual wells and septic tanks and therefore require a larger than average lot. No known homes on Flint Lake are known to be using septic tanks.

Approximately 85% of the buildable land within the overall watershed is already developed (see Plate 10 and Exhibit 6 - Present and Potential Land Use). As mentioned previously, new developments are currently being planned for the few remaining vacant parcels.

The available land within the corporate limits of Valparaiso is located in areas where the runoff would be controlled in detention basins prior to being discharged to Flint Lake. The only available land within the unincorporated area of this watershed whose runoff would not be controlled in an existing lake or detention basin is located southeast of Flint Lake.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

910 Roosevelt Road
Valparaiso, IN 46383

SUBJECT: Soil Erosion
Flint Lake Conservancy District

DATE: March 28, 1988

TO: Mr. Ordell Gertsmeier
158 South Napoleon Street
Valparaiso, IN 46383

In reply to your request the following report is forwarded to you.

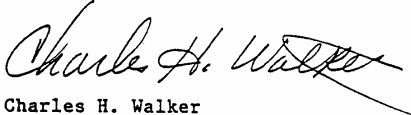
Policy: "These soil, water and related resource data and/or interpretations were developed by the Soil Conservation Service and furnished to the local Soil and Water Conservation District for carrying out the local SWCD Program as authorized under state enabling legislation."

Soils Identified:

MrB2 - Morley Silt Loam, 2 - 6% slopes, eroded
MrC2 - Morley Silt Loam, 6 - 12% slopes, eroded
MrD2 - Morley Silt Loam, 12 - 18% slopes, eroded
MrE - Morley Silt Loam, 18 - 30% slopes, eroded
BaA - Blount Silt Loam, 0 - 3% slopes
Pe - Pewamo Silty Clay Loam
Wh - Washtenaw Silt Loam
Hm - Houghton Muck
RiB - Riddles Silt Loam, 0 - 2% slopes
Pa - Palms Muck
Wa - Walkill Silt Loam
Wt - Whitaker Loam
Rab - Rawson Loam, 2 - 6% slopes
UcG - Udorthents, loamy, 3 - 30% slopes, eroded

Approximately 90 per cent of the soils in the Flint Lake Conservancy District area are considered highly erodible land. They have moderate to severe limitations for urban development.

Unless dwellings are designed to fit the slope, extensive earth moving is required to level the area sufficiently for construction. Developing lots at random and retaining as much of the vegetative cover as possible in other areas helps to reduce erosion. Other ways to reduce erosion are to construct housing on the contour so that roads will be placed on the contour and to build diversions between lots to intercept runoff.



Charles H. Walker
District Conservationist

Enclosure





PRESENT AND POTENTIAL LAND USE
IN FLINT LAKE WATERSHED

TOTAL ACREAGE: 2,430

	All Uses	Lake, Ponds and Wetlands	Zoned for Residential	Zoned for Commercial
Area per Use (acres)	2,430	454	1,916	60
Percent of Total	100	19	79	2

Undeveloped (acres)	444	---	432	12
Percent of Undeveloped	100	---	97	3
Percent of Total	18	---	18	0.5

ANALYSIS OF FLINT LAKE WATER AND LAKE BOTTOM

Testing of Stream Flow into Flint Lake

An analysis of the stream flow was made at three major inlets into Flint Lake, and a composite test was made at a point where the waters from these inlets converge. Water samples were taken on October 17 and October 18, 1988 at the beginning, during and after a rainstorm. This testing was performed to determine quality of water flowing into the lake and within the lake itself (see Exhibit 7 - Northern Laboratories and Engineering, Inc. Report dated November 1, 1988). The test locations, shown on the map which accompanies the Laboratory Report, are as follows:

- Site #1 Combined Heinold/Listenberger Drain and
Cooks Corners-Concord Woods-Kingsridge-Woodside Storm Drain
- Site #2 Composite Sample in the Lake
- Site #3 Long Lake - Flint Lake Connecting Drain
- Site #4 Loomis Lake Drain

The following laboratory results were considered high for these given sites:

Site #1, the Combined Heinold/Listenberger Drain and Cooks Corners-Concord Woods-Kingsridge-Woodside Storm Drain

1. The Total Suspended Solids increased to 33 mg/L during the height of the storm event.
2. Fecal Coliform counts were greater than 6000/100 mL during the height of the storm event.

Site #2, the Composite Sample in the Lake

1. Fecal Coliform ranged from 5/100 mL to 600/100 mL, with less than 400/100 mL being the acceptable count for in-lake samples.

Site #3, Long Lake - Flint Lake Connecting Drain

No results considered high.

Site #4, Loomis Lake Drain

No results considered high.

At the time that these samples were obtained, the three lakes (Flint, Long and Loomis) were not interconnected because of low water levels. Due to this, tests were also run on water from Long and Loomis Lakes. These additional samples were obtained at the two locations where the lakes would be connected were the water levels higher (See Exhibit 8 - Laboratory Report dated December 5, 1988).

Long Lake site

The laboratory results for the water in Long Lake were not considered excessive; however, total phosphorus, nitrate, and total kjeldahl nitrogen were higher in Long Lake than in Flint Lake.

Loomis Lake site

The laboratory results for the water in Loomis Lake were not considered excessive; however, total phosphorus, nitrate, and total kjeldahl nitrogen were higher in Loomis Lake than in Flint Lake.

Generally, the test results did not deviate a great deal between the start of the storm, during the storm, and after the storm. The only variations considered high occurred during the height of the storm. This is not alarming and is probably due to increased runoff carrying sediment and animal wastes from adjoining lots and inlet streams.

These test results show that the quality of water flowing into Flint Lake and within the lake itself is good. It is evident that the upstream lakes, ponds and wetlands are acting as safeguards to Flint Lake.

These results have been tabulated and are shown on Plate 11.

ANALYSIS OF FLINT LAKE WATER AND LAKE BOTTOM

<u>Parameter</u>	<i>H/L</i> Flint Lake South Inlet <u>Site #1</u>	<i>in-lake</i> Flint Lake Composite <u>Site #2</u>	Flint Lake Long Inlet <u>Site #3</u>	Flint Lake Loomis Inlet <u>Site #4</u>	Long <u>Lake</u>	Loomis <u>Lake</u>
pH	7.4 - 7.9	7.2 - 7.7	7.2 - 7.7	7.2 - 7.5	7.0	7.3
BOD	< 2.0	< 2.0	< 2.0	2.0 - 2.1	2.6	5.5
Total Suspended Solids	2.5 - 33	< 2.5	< 2.5	2.5 - 13	< 2.5	7.0
Grease and Oil	2.0 - 5.1	2.4 - 6.5	3.3 - 4.4	2.0 - 4.4	2.5	3.0
Ammonia-Nitrogen	0.10 - 0.15	< 0.10	< 0.10	0.10 - 0.11	< 0.10	< 0.10
Nitrate-Nitrite	0.03 - 0.80	< 0.03	< 0.03	0.03 - 0.06	0.06	0.14
Total Phosphorus	0.02 - 0.10	0.02	0.01 - 0.02	0.02 - 0.04	0.05	0.07
Total Kjeldahl-Nitrogen	0.78 - 1.2	0.51 - 0.90	0.65 - 0.93	0.67 - 0.85	1.24	1.17
Fecal Coliform	2 - 6000	5 - 600	6 - 100	7 - 200	200	4

Flint Lake Classification Based on Eutrophication Index

Introduction

Twenty years ago, the State of Indiana initiated programs directed towards the study of the water quality and the subsequent classification of all the lakes in the State. Based on these studies, Indiana lakes were classified in terms of size, depth, water quality, and finally their eutrophic state.

This classification allows the comparison between the lakes and the prioritization of lakes in terms of their need for protection and renovation. It also provides the State with the necessary elements to formulate a workable lake management plan.

Eutrophication Index (EI)

The fundamental concepts of lake classification based on its trophic state date back to the studies of Weber (1907). It became evident from these and later studies that nutrient inputs to the lake collectively cause eutrophic conditions. Phosphorus and nitrogen have been identified as important parameters in the process. Other parameters impact the process of eutrophication and are also related to the concentration of the nutrients.

The Eutrophication Index for a lake is a number obtained by adding the eutrophy points of the parameters which impact the trophic state of the lake.

A list of each parameter, parameter ranges and the assigned eutrophy points for each range are shown as Exhibit 9.

Eutrophication Index on Flint Lake

The Eutrophication Index for Flint Lake was found to be 25 in a study conducted in 1972 by the Indiana Department of Environmental Management. Of 401 lakes for which index values were calculated, 111 or 28% had a value less than 25. An index of 25 places the lake in the high quality, least eutrophic range (Class I) which contains scores ranging from 0 to 25. Flint Lake was one of eight lakes in the overall watershed which were studied and classified:

Moss Lake	24
Flint Lake	25
Wauhob Lake	31
Long Lake	33
Canada Lake	39
Spectacle Lake	40
Mink Lake	50
Loomis Lake	56

An index of 25 on Flint Lake was a very good classification when compared to other lakes in Indiana. Considering the fact that this lake is used as a source for potable water for Valparaiso and considering the extensive use of the lake for recreational purposes, this range of index must be maintained.

Procedure for New Flint Lake Eutrophication Index

The procedure used to evaluate the Flint Lake EI was carried out by Northern Laboratories & Engineering, Inc. (NLE) staff. On July 18, 1989 NLE staff sampled the lake at the deepest point. This point was evaluated using the sound equipment in the sampling boat. Samples were obtained for the determination of: total phosphorus; soluble phosphorous; organic nitrogen; nitrate nitrogen; ammonia nitrogen; dissolved oxygen (percent saturation at 5 feet from surface); dissolved oxygen (percent of measured water column with at least 0.1 mg/L D.O.); light penetration (Secchi Disc); light transmission (photocell); total plankton (5 feet depth); total plankton (one vertical tow at beginning of the thermocline).

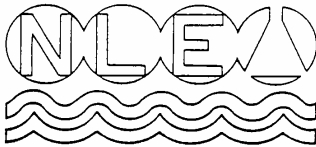
Equipment Used and Methods of Analyses

- Total and Dissolved Phosphorous, Method #365.2
"Methods for Chemical Analysis of Water and Wastes"
US EPA, 1979
- Nitrogens
Lachate Equipment
- Dissolved Oxygen (D.O.), Method #422F
D.O. probe connected to a D.O. meter with battery
"Standard Methods for the Examination of Water and Wastewater"
16th Edition
- Dissolved Oxygen (D.O.), Method #422B
Winkler Titration
"Standard Methods for the Examination of Water and Wastewater"
16th Edition
- Light Penetration
This test was determined using a Secchi Disc
WILDCO, (Wildlife Supply Company) Model 58B-10
- Light Transmission
Quantum/Radiometer/Photometer
Li-COR Model LI-185B
- Total Plankton
Fine mesh Birge Sampler 80 ug
WILDCO, (Wildlife Supply Company) Model 21
- Sedgewick-Rafter Counting Cell
WILDCO, (Wildlife Supply Company) Model 1801

New Eutrophication Index

In 1972 the State established a Eutrophication Index of 25. A study conducted by Northern Laboratories & Engineering, Inc. on July 18, 1989 resulted in a new index of 10. The results of the testing and the assignment of Eutrophy Points are shown on Plates 12 and 13. A tabulation of the temperature of the water and the dissolved oxygen for various depths is shown on Plate 14.

A certain amount of variability is inherent in the index because of seasonal variation, sampling variation, etc. This variability can be as much as 10 points. Considering the maximum variation, the new EI value (10) still represents an improvement in water quality in Flint Lake.



NORTHERN LABORATORIES AND
ENGINEERING, INC.
ENVIRONMENTAL CONSULTING AND TESTING

February 5, 1990

Mr. Ordell Gertsmeier
PTGR, Inc.
158 South Napoleon Street
Valparaiso, IN 46383

Dear Mr. Gertsmeier:

SUBJECT: FLINT LAKE EUTROPHICATION INDEX

Enclosed are the depth, temperature, and dissolved oxygen figures, Table A-1.

In figuring the percent dissolved oxygen (DO) at five feet, we used the figure of 7.3 mg/L. We used the saturation value of temperature of 25.5°C at 8.3 mg/L. This percent of 7.3 to 8.3 gave 88% which correlates to eutrophy points of zero as shown in Table A of our letter dated January 19, 1990. Please note that the figure in that table was typed wrong and is corrected in the attached copy of Table A.

The item VII in Table A was determined after consultation with the staff of IDEM. Since our equipment did not have the necessary length to establish the level where 0.1 mg/L DO was obtained, it was decided that, based on previous studies made on Flint Lake, the percent of water column with 0.1 mg/L DO may be evaluated by dividing the depth of 24 feet (assumed to contain 0.1 mg/L DO) by the depth of our point of measurement, which was 60 feet. This ratio will be 40% which gives eutrophy points of 3.

I hope this information satisfies your needs. Should you have any further comments or questions, please do not hesitate to contact me.

Sincerely,

A. Sami El-Naggar, Ph.D., P.E.
President

ASE/akf

Attachment

2400 CUMBERLAND DR. VALPARAISO, INDIANA 46383 PHONE: 219-464-2389 FAX: 219-462-2953

TABLE A-1

Temperature and Dissolved Oxygen Values at Different Depths
for Flint Lake

<u>Depth (feet)</u>	<u>Temperature °C</u>	<u>Dissolved Oxygen mg/L</u>
1	25.5	8.0
3	25.5	6.7
6	25.5	7.5
9	25.5	4.0
10	25.0	
11	23.5	
12	22.0	2.0
13	20.5	
14	19.0	
15	17.0	0.4
16	16.0	
17	15.0	
18	14.0	0.5
19	13.5	
20	12.5	
21	12.0	
24	12.0	

Total depth at point of sampling is 60 feet

CONCLUSIONS AND RECOMMENDATIONS

Conclusions and Summarization of Findings

The purposes of this study were to determine the quality of water and the extent of sedimentation in Flint Lake to provide recommendations to improve water quality.

Included in the study are:

1. a review of historical data to determine the trend of water quality and water levels in the lake;
2. the sampling of lake water at various point sources to determine the quality of runoff;
3. the determination of the current Eutrophication Index;
4. the determination of the elevation of the lake bottom in the southwest portion and the search for any evidence of sedimentation;
5. an analysis of the overall watershed to determine land use, growth and runoff.

The quality of water in Flint Lake has actually improved over the past 17 years. This is evidenced by an Indiana Department of Natural Resources study of plant growth within the lake, results of tests for fecal coliform counts at two beaches on Flint Lake performed by the Porter County Health Department, testing of stream flow by Northern Laboratories & Engineering, Inc., and determination of the current Eutrophication Index for Flint Lake.

The results of the aquatic plant growth study showed a great improvement over conditions that previously existed in the area. Due to the decline in plant growth, the assumption can be made that concentrations of phosphorous and nitrogen have also decreased.

The Porter County Health Department has had a continuing monitoring program of two beaches on Flint Lake. Results of tests taken before and after installation of the sanitary sewers showed a reduction in fecal coliform counts in excess of 200/mL. These tests substantiate that effluent from malfunctioning septic systems is no longer a problem in Flint Lake. However, some homes located on upstream lakes are still being served by individual septic systems. These systems are closely monitored by the Porter County Health Department to assure proper operation. Although malfunctions occasionally occur, the impact on Flint Lake itself is minimal due to dilution and buffering. However, construction of sanitary sewers within the overall watershed should be encouraged to protect other bodies of water from possible contamination from effluent.

Runoff water flowing into Flint Lake was tested by Northern Laboratories & Engineering, Inc. at three major inlets and at a point where the waters from these inlets converge. Water samples were taken at the beginning, during and after a rainstorm. Generally, the test results did not deviate a great deal and showed that the quality of water flowing into Flint Lake and in the lake itself is good. It is evident that the upstream lakes, ponds and wetlands are acting as safeguards to Flint Lake.

The Eutrophication Index for Flint Lake was previously found to be 25 in a study conducted in 1972 by the Indiana Department of Environmental Management. As a part of this study, a new Eutrophication Index of 10 was determined by Northern Laboratories & Engineering, Inc. This new index must be maintained. Long term solutions to the problems of eutrophication require measures designed to prevent nutrients from entering a lake. Such measures include the divergence or deletion of sewage effluents and the improvements of development practices to prevent eroded soil from being carried into a lake.

If the lake were to be experiencing a sedimentation problem, it would probably occur at the inlet in the Southwest corner. In contrast to other inlets, there are no intervening lakes to buffer the influent before it enters Flint Lake. There is a large wetlands area, however, through which the runoff must flow. Evidence indicates that this wetlands has performed very well as a sediment trap protecting the lake from significant siltation in this area. It would be very advantageous if the wetlands could be enhanced to continue functioning in this manner.

This study indicates that excessive sediment and/or nutrients are not currently being carried into Flint Lake. However, adjoining lakes, ponds and wetlands are acting as sediment and nutrient traps and must be protected and enhanced to aid in their continuation.

Specific Recommendations and Improvements

Recommendations for enhancing the water quality in Flint Lake include the following:

1. Legal and Governmental

- A. Preserve the wetlands at the inlets into the lake and throughout the District by adopting and enforcing an ordinance regarding Wetlands Preservation and/or Protection;
- B. Continue to protect the adjoining ponds, lakes and wetlands from excessive sedimentation by controlling erosion from all building sites within the District. This can be accomplished by strictly enforcing the Erosion Control Ordinance adopted by the Board of Directors of the Valparaiso Lakes Area Conservancy District. Of particular interest should be the undeveloped area Southeast of Flint Lake. The Board of Directors of the Conservancy District should require the construction of detention basins which would act as sediment traps;
- C. Continue to encourage the Plan Commissions and the governing agencies in the City of Valparaiso and Porter County to adopt and enforce Erosion Control Ordinances for the respective areas under their jurisdiction. This will provide assurances that excessive erosion will be controlled in areas outside of the District Boundary but still within the overall watershed to Flint Lake;
- D. Continue to encourage the construction of sanitary sewers to serve homes around the upstream lakes and wetlands. In addition, it is very important that all of the homes within the watershed be served with sanitary sewers. Towards that end, the homes on the shores of Long Lake and the homes on the south side of Loomis Lake would be encouraged to connect to sanitary sewers. The owners of the homes on Loomis Lake are presently discussing being annexed to the City of Valparaiso so that sanitary sewers could be extended into that area.

2. The Area's Best Management Practices

- A. The smallest practical area of land should be exposed at any one time during development;
- B. When land is exposed during development, the exposure should be kept to the shortest practical period of time;
- C. Temporary vegetation and/or mulching should be used as needed to protect critical areas exposed during development;
- D. Sediment/nutrient filter basins should be installed as needed to remove sediment from runoff waters and land undergoing development;
- E. Natural vegetation should be retained and protected as much as possible;
- F. Topsoil should be saved for re-spreading over areas with poor soil quality to facilitate establishing vegetative growth;
- G. The permanent final vegetation should be established and structures installed as soon as practical in the development;
- H. The development plan should be fitted to the topography and soils so as to create the least possible danger from erosion and/or wetness;
- I. Detention reservoirs should be constructed where needed to reduce flooding by detaining surface water runoff and metering this runoff into natural or artificial drains;
- J. Grassed waterways and surface drainage channels should be installed as needed to safely remove ponded and/or excess water;
- K. Drainage channels and interconnecting detention reservoirs should be planned to provide maximum open space and scenic benefits as well as necessary water management benefits;
- L. No construction excavation, deposit, or fill should be placed where it will adversely affect the floodway of a watercourse;
- M. Soils in a floodplain should remain in open space use or be placed into uses for which flooding is not detrimental;
- N. A central sewage system should be made available in all developments that exhibit soils with severe or very severe limitations for septic tanks and soil absorption fields as determined by a Soil Survey by USDA - Soil Conservation Service in cooperation with Purdue University Agriculture Experimental Station (see Indiana State Board of Health S.E. 8).

3. Construction Measures

- A. Construct a sediment trap (or two in series) in line with the discharges at the Southwest corner of the lake (see Exhibit 11 - Proposed Construction Improvements). The trap(s) should be upstream from the main body of the existing wetlands.

The project would involve the acquisition of approximately two acres of land, the relocation of a private roadway and reconstruction of the end of the Sumac Drive storm sewer. The basin is proposed at approximately 50' x 200' x 10', or equivalent. The entrance culvert (existing under Clausson Lane) would be replaced with two - 50" x 31" CMP arches. Discharges from the basin would be over riprap weirs to direct the flows throughout the wetlands areas.

- B. Construct control structures, if possible, at both the existing channel and culvert into the lake (see Exhibit 11 - Proposed Construction Improvements). These structures would maintain a minimum water level in the wetlands during dry periods. This would allow the wetlands to function to their maximum capability as "filters".

Such structures would cause water levels to remain "unnaturally" on private lands for longer periods of time. This could lead to liability problems for the District unless these types of legal issues are cleared. They must be investigated in greater detail before any real consideration can be given to constructing the control structures.

The main structure (West) is anticipated to be a sheet pile weir with a riprap drop structure. The secondary structure (East) would replace an existing culvert under Island Road with a new 12" diameter culvert with a 24" diameter standpipe and anti-vortex plate.

4. Monitoring

- A. Monitor both Flint Lake and selected ponds and lakes upstream from Flint Lake to assure that they remain viable sediment and nutrient traps;

Three suggested monitoring techniques are suggested for each individual station. Exact locations within these water bodies should be located and marked with buoys or carefully referenced from markers on shore. Then at each location once yearly in July, the following should be read:

1. Clarity to be determined with a standard Secchi Disc reading;
 2. Aquatic vegetation measured as estimated density and height from water's surface;
 3. Sediments measured as depth from top of permanent marking stake.
- B. Conduct soundings on the lake bottom in the southwest side of the lake at periodic intervals to monitor any increased sedimentation;
- C. Continue to monitor aquatic plant growth in the lake to determine if there is a marked increase.

Indiana's T by 2000 Program for Assistance

In addition to funding this preliminary lake study, the T by 2000 program offers many other avenues of help and support.

The local Soil and Water Conservation District (SWCD) is the key group offering support. They work with local groups, County government, and County-Based Federal and State agencies such as the USDA Soil Conservation Service (SCS) and Purdue Cooperative Extension Service to assist landusers in soil and water conservation efforts. Everything from technical assistance to cost sharing projects are available through this program (see Exhibit 12 - T by 2000 brochures). Specifically, Flint Lake and its watershed should take advantage of all the following programs:

1. Soil Conservation Education Assistance

Increasing public awareness and understanding of erosion/sedimentation programs and how they can be controlled.

The Conservancy District should encourage all developers within the watershed to visit with the local Soil Conservation Service office. They should be strongly guided to use SCS related soil conservation practices.

2. Agricultural Erosion Control Technical Assistance

Helping agricultural landusers to assess their specific problems and develop and apply appropriate solutions.

Although agri-lands are limited in the watershed, those lands have a very high degree of erodibility. The Soil Conservation Service has been a leader for years in erosion control. Agri-producers should be made aware of their effects on the lakes and strongly encouraged to take advantage of the SCS soil conservation programs.

3. Cropland Erosion Control Cost-Share Program

Making cost-share funds available to landusers with cropland erosion programs requiring installation of expensive corrective measures.

Cost sharing on erosion control structures such as catch basins and grass waterways could "get the job done" and insure quality water inputs to the lake system.

4. Non-Agricultural Erosion Control Technical Assistance

Working with non-ag landusers to assess soil suitability at development sites and to minimize erosion problems before, during, and after development.

This program is ideally suited to this watershed. The high probability of all lands being developed and the erosive nature of those morainic soils naturally spell problems. Developers should be required to, as a minimum, have a SCS developed soil conservation plan for each development.

5. Lake Enhancement Program

Providing technical and financial help to control sediment and associated nutrient problems in public-access lakes.

The Valparaiso Lakes Area Conservancy District should develop plans for the inlet desilting/nutrient filter and pursue the acquisition of funding for the project through the T by 2000 Lake Enhancement Program.

Required Permits

The construction of channels, dredging of the lake bed, filling, or any other construction or excavation affecting a public fresh water lake requires the approval of the Indiana Department of Natural Resources (IDNR). In addition, any dredging, constructing, repairing, or recleaning of a ditch or drain will also require a permit from IDNR when that ditch or drain:

1. is located within one-half mile of a fresh water lake of 10 acres or more, and
2. has a bottom depth lower than the normal water level in that lake.

Any filling of any portion of the lake or wetlands requires the approval of the U. S. Army Corps of Engineers. Since the specific location of wetland boundaries is not available on any maps, any construction work either for the Lakes project or private construction should have the wetland parameters delineated using the U. S. Army Corps of Engineers jurisdictional criteria. Any construction on or within the legal drains such as the Listenberger Storm Sewer or Drain requires the approval of the Porter County Drainage Board, and possibly also the Indiana Department of Natural Resources.

Natural Areas and State Listed Species

No significant high quality natural areas are known to occur within the Flint Lake watershed.

Several listed species are thought to exist in the Flint Lake watershed. Please see enclosed correspondence from Indiana Department of Natural Resources - Division of Nature Preserves (Plate 15).



INDIANA DEPARTMENT OF NATURAL RESOURCES

PATRICK R. RALSTON, DIRECTOR

Division of Nature Preserves
605B State Office Building
Indianapolis, Indiana 46204-2267
317-232-4052

August 23, 1990

Ordell Gertsmeier
PTGR, Inc.
158 Napoleon
Valparaiso, IN 46383

Dear Mr. Gertsmeier:

Enclosed is the information per your request of 8/13/1990. No significant high quality natural areas or nature preserves are known to occur within the Flint Lake watershed. This does not connote that wetlands within this area are not valuable. In fact the wetlands associated with this lake system are notable for their extent and habitat values. You will note that the rare species on the attached list are all wetland or lake dependent. Any recommendations or proposals resulting from your study should take into account impacts upon these species and minimize any detrimental effects.

If you need any more information or have any questions, please do not hesitate to contact me.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Hank Huffman', written over a horizontal line.

Hank Huffman

HHH/kjw

Enclosure

"EQUAL OPPORTUNITY EMPLOYER"

22 AUG 1990

STATE LISTED SPECIES DOCUMENTED FROM THE FLINT LAKE WATERSHED
IN PORTER COUNTY, INDIANA

Species Name.....	Common Name.....	State	Fed	Stat	Stat	Date
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Chesterton Quadrangle

Flint Lake:

CLEMYS GUTTATA	SPOTTED TURTLE	ST				1934
EMYDOIDEA BLANDINGI	BLANDING'S TURTLE	SSC				1934

Long Lake Wetlands:

IXOBRYCHUS EXILIS	LEAST BITTERN	SSC				1983
NYCTICORAX NYCTICORAX	BLACK-CROWNED NIGHT-HERON	SE				1982
RALLUS ELEGANS	KING RAIL	SE				1916

Spectacle Lake:

EMYDOIDEA BLANDINGI	BLANDING'S TURTLE	SSC				1934
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Wauhob Lake:

POTAMOGETON DIVERSIFOLIUS	WATER-THREAD PONDWEED	WL				1972
POTAMOGETON RICHARDSONII	REDHEADGRASS	SE				1980

Valparaiso Quadrangle

No elements

STATE: SE=endangered, ST=threatened, SR=rare, SSC=special concern, WL=watch list

Estimated Cost of Improvements

1. Monitoring

Monitoring Flint Lake and selected ponds and lakes upstream for clarity, vegetation and sedimentation

- a. Initial testing (includes determination of optimum test locations, marking locations with buoys or tying same to reference markers on shore, and obtaining initial test readings)

6 locations at \$1,000/each \$ 6,000

(subsequent tests are estimated at \$200 each location each occurrence if performed by consultant. District should investigate the use of volunteers to perform this work. See brochure at end of report.)

- b. Lake bottom soundings at Southwest corner of lake re: sediment accumulations

Each occurrence \$ 600

- c. Check on aquatic plant growth in Flint Lake

No cost per this estimate

\$ 6,600

2. Ordinance regarding Wetlands Preservation and/or Protection

Legal \$ 4,000
Administrative 2,000

\$ 6,000

3. Construction of Sediment Trap (Basin)

Land Purchase, Easements, Agreements:

2 Acres at \$4,000	\$ 8,000	
Surveys	2,250	
Legal	<u>1,750</u>	
		\$ 12,000

Permits:

For consultant's preparation of applications
and supporting data necessary to obtain
permits from:

Indiana Department of Natural Resources	\$ 3,000	
U. S. Army Corps of Engineers	6,000	
Local (Miscellaneous)	<u>3,000</u>	
		12,000

Design:

Survey (Topographic)	\$ 2,000	
Engineering	<u>14,000</u>	
		16,000

Construction:

Excavation		
4,000 C.Y. @ \$8.00	\$32,000	
Culverts at Existing Drive		
2 - 50" x 31" CMPA, 40 L.F. @ \$75.00	3,000	
End Sections for Culverts		
4 Each @ \$550.00	2,200	
Reconstruct North End of Sumac Sewer (L.S.)	4,500	
Riprap Slope Protection at Inlet Culverts		
2 Each @ \$1,500.00	3,000	
Riprap Slope Protection at Discharge Weirs (L.S.)	3,000	
Relocate/Reconstruct Existing Private Roadway		
360 L.F. @ \$50.00	18,000	
Restoration - Mulched Seeding		
3 Acres @ \$800.00	2,400	
Erosion Control During Construction L.S.	<u>1,200</u>	
		69,300

Contingencies (10% of Construction)

<u>6,930</u>
<u><u>\$ 116,230</u></u>

4. Construction of Water Level Control Structures

Land Purchase, Easements, Agreements:

0.5 Acre @ \$4,000	\$ 2,000	
Easement(s)	1,500	
Surveys	1,250	
Legal	<u>1,250</u>	\$ 6,000

Permits:

Indiana Department of Natural Resources	\$ 4,000	
U. S. Army Corps of Engineers	8,000	
Local (Miscellaneous)	<u>3,500</u>	15,500

Design:

Survey (Topographic)	\$ 1,500	
Survey re: Critical Elevations Around Wetlands	3,500	
Engineering and Studies	22,000	
Legal	<u>4,000</u>	31,000

Construction:

Main Structure (West):

Excavation/Fill	\$ 3,500	
Weir Structure	17,500	
Riprap Spillway	2,500	
Restoration	<u>1,750</u>	25,250

Secondary Structure (East):

Excavation/Fill	\$ 1,500	
12" Diameter CMP		
40 L.F. @ \$31.00	1,240	
24" Diameter Standpipe on Foundation	2,750	
Restoration	<u>1,150</u>	6,640

Contingencies (10% of Construction)

<u>3,190</u>
<u><u>\$ 87,580</u></u>

5. Continue to protect adjoining ponds, lake and wetlands from excessive sedimentation

\$ -0-

6. Continue to encourage adoption and enforcement of Erosion Control Ordinances for areas outside of the District but within the overall watershed

\$ -0-

7. Continue to encourage construction of sanitary sewers to serve homes around the upstream lakes and wetlands

\$ -0-

Exhibit 1-Court Order

STATE OF INDIANA)
) SS:
 COUNTY OF PORTER)

PORTER CIRCUIT COURT

IN RE: THE PETITION FOR THE)
 ESTABLISHMENT OF THE)
 VALPARAISO LAKES AREA)
 CONSERVANCY DISTRICT)

FILED
 Cause No. 75-PCC-5
 IN COURT

COURT ORDER

MAR 2 1983

Comes now the Court, and, pursuant to Section 4 of the Indiana Conservancy Act (as amended), does now hold a public hearing for purposes of hearing evidence on the propriety of a certain petition for addition of additional purposes to the Valparaiso Lakes Area Conservancy District, making findings of fact and ruling on the propriety of said petition. After receiving said petition, hearing the evidence and being duly advised in the premises, the Court now makes the following findings and enters the following Order.

The Court finds that pursuant to the salient provisions of the Indiana Conservancy Act, notice by publication was made in the Valparaiso Vidette-Messenger Newspaper and in the Porter County Herald Newspaper on January 27, 1983 and February 3, 1983. The Proof of Publication of said notice of public hearing being in the following words and figures: (H.I.).

The Court further finds that the Petitioners have complied with all statutory notice by mail requirements. Such notice is being that which are deemed necessary by the Court for its conducting of this hearing, and the Court further finds that said notices are in compliance with the salient notice provisions of the Indiana Conservancy Act.

The Court further finds that the Board of Directors of the Valparaiso Lakes Area Conservancy District has received a petition for inclusion of additional purposes for the Valparaiso Lakes Area Conservancy District signed by 179 freeholders of the District. The Court further finds there to be a total of 1,192 freeholds within the District, and as such, the aforementioned petitions were signed by 15 percentage of the freeholders. The aforementioned petitions for inclusion of additional purposes are to be found in the following words and figures: (H.I.).

The Court finds said petitions to be in proper form and does accept the filing of same with the Court.

The Court further finds that on the 17th day of November, 1982, the Board of Directors of the Valparaiso Lakes Area Conservancy District (pursuant to statute) accepted the aforementioned petitions for inclusion of additional purposes and adopted a resolution directing their legal counsel to file the aforementioned petitions for inclusion of additional purposes with the Circuit Court of Porter County for consideration by the Court. Minutes of the aforementioned meeting are in the following words and figures: (H.I.).

The Court finds said resolution by the Board of Directors to be in proper form and does accept the filing of same.

The Court further finds, on the basis of a letter received by the Court from Mr. Robert F. Jackson, P.E. Chief Division of Water, Indiana Department of Natural Resources, said letter being in the following words and figures: (H.I.), that the Department of Natural Resources of the State of Indiana has no objection to the proposed addition of additional purposes.

The Court further finds that on the basis of all of the relevant testimony and evidence submitted at the hearing that with reference to the specific purposes for which this Court created the Valparaiso Lakes Area Conservancy District on September 3, 1975, the proposed addition of the purposes of the preventing of loss of topsoil from injurious water erosion, the purpose of flood prevention, are both necessary and economically and engineeringly feasible. The Court further finds that with reference to the specific purposes for which the Valparaiso Lakes Area Conservancy District was originally created by this Court, the addition of the aforementioned purposes will offer benefits in excess of costs and damages to the existing Conservancy District and the public health in the Conservancy District will be served immediately and prospectively by the addition of the aforementioned purposes. The Court further finds that the adding of the aforementioned additional purposes will be consistent with

the orderly development of the District and will not adversely effect or in any way impact any of the land within the Conservancy District. The Court further finds that the petition for addition of additional purposes can be accomplished in a manner and fashion as to be consistent with the existing purposes of the Conservancy District, flood control projects, reservoirs, lakes, drains, levies, and other water management or other water supply projects in the area.

WHEREFORE, it is now ordered, adjudged and decreed by this Court that the relief sought by the petitioners herein is proper and that said relief should be granted.

It is further ordered, adjudged and decreed by this Court that the petition for inclusion of additional purposes for the Valparaiso Lakes Area Conservancy District as now before this Court is legally sufficient and that the Board of Directors of the Valparaiso Lakes Area Conservancy District has, by resolution and unanimous vote, recommended to this Court that the additional purposes be added to the District.

It is further ordered, adjudged and decreed by this Court that the additional purposes referred to in the aforementioned petition that of preventing the loss of topsoil from injurious water erosion and the purpose of flood control and prevention ought to be, and the same are hereby, added into and made a part of the purposes for which this Court originally created the Valparaiso Lakes Area Conservancy District.

It is further ordered, adjudged and decreed by this Court that from this day forward the Court Order authorizing and establishing the Valparaiso Lakes Area Conservancy District shall be amended to include these additional purposes so that the District henceforth shall have the following purposes:

1. Providing water supply, including treatment and distribution for domestic, industrial and public use;
2. Providing for the collection, treatment and disposal of sewage and other liquid wastes produced within the District;
3. Improving drainage;
4. Preventing the loss of topsoil from injurious water erosion; and
5. Flood prevention and control.

It is further ordered, adjudged and decreed by this Court that the Board of Directors of the Valparaiso Lakes Area Conservancy District are now instructed to commence actions and activities with regard to these new purposes and specifically are instructed to commence the appropriate amendments and additions to the District plan so that the new purposes can be addressed and implemented.

All of the above having been ordered, adjudged and decreed this 2nd day of March, 1983.

A handwritten signature in black ink, appearing to read "Wm. D. Keith", is written over a horizontal line.

Judge, Porter Circuit Court

Exhibit 2-Ordinance 888-1

ORDINANCE 88-1

AN ORDINANCE PROVIDING FOR THE CONTROL OF
SOIL EROSION AND SEDIMENTATION FROM AREAS UNDERGOING
DEVELOPMENT IN THE VALPARAISO LAKES AREA CONSERVANCY DISTRICT

ARTICLE I
FINDINGS AND PURPOSE

A. Findings

The Board of Directors of the Valparaiso Lakes Area Conservancy District hereby finds that:

1. Excessive quantities of soil may erode from areas undergoing development for certain non-agricultural uses including but not limited to the construction of dwelling units, commercial buildings and industrial plants, the building of roads and highways, and the creation of recreational facilities;
2. The washing, blowing, and falling of eroded soil across and upon roadways endangers the health and safety of users thereof by decreasing vision and reducing traction of road vehicles;
3. Soil erosion necessitates the costly repairing of gullies, washed-out fills, and embankments;
4. Sediment from soil erosion tends to clog sewers and ditches and to pollute and silt rivers, streams, ponds, lakes, and reservoirs;
5. Sediment limits the use of water and waterways for most beneficial purposes, promotes the growth of undesirable aquatic weeds, destroys fish and other desirable aquatic life, and is costly and difficult to remove; and
6. Sediment reduces the channel capacity of waterways, resulting in increased chances of flooding at risk to public health and safety.

B. Purpose

The Board of Directors of the Valparaiso Lakes Area Conservancy District hereby declares that the purpose of this ordinance is to safeguard persons, protect property, prevent damage to the environment, and promote the public welfare by guiding, regulating, and controlling the design, construction, use, and maintenance of any development or other activity which disturbs or breaks the topsoil or otherwise results in the movement of earth on land situated in the Conservancy District.

ARTICLE II
DEFINITIONS

For the purposes of this ordinance certain terms used herein shall be defined as set forth below:

BUILDING PERMIT means a permit issued by the Porter County Plan Commission for the construction, erection, or alteration of a structure or building.

CERTIFY or CERTIFICATION means formally attesting that the specific inspections and tests where required have been performed, and that such tests comply with the applicable requirements of this ordinance.

CUBIC YARDS means the amount of material in excavation and/or fill measured by the method of "average end areas."

DISTRICT means the Valparaiso Lakes Area Conservancy District.

EROSION means the wearing away of the land surface by the action of wind, water, or gravity.

EXCAVATION means any act by which organic matter, earth, sand, gravel, rock, or any other similar material is cut into, dug, quarried, uncovered, removed, displaced, relocated, or bulldozed and shall include the conditions resulting therefrom.

EXISTING GRADE means the vertical location of the existing ground surface prior to excavation or filling.

FILL means any act by which earth, sand, gravel, rock, or any other material is deposited, placed, replaced, pushed, dumped, pulled, transported, or moved by man to a new location and shall include the conditions resulting therefrom.

FINAL GRADE means the vertical location of the ground or pavement surface after the grading work is completed in accordance with the site development plan.

GRADING means excavation or fill or any combination thereof and shall include the conditions resulting from any excavation or fill.

NATURAL DRAINAGE means channels formed in the existing surface topography of the earth prior to changes made by unnatural causes.

PARCEL means all contiguous land in one ownership

PERMITTEE means any person to whom a site development permit is issued.

PERSON means any individual, firm or corporation, public or private, the State of Indiana and its agencies or political subdivisions, and the United States of America, its agencies and instrumentalities, and any agent, servant, officer, or employee of any of the foregoing.

REMOVAL means cutting vegetation to the ground or stumps, complete extraction, or killing by spraying.

SEDIMENT means matter which settles to the bottom of a stream or lake.

SEDIMENTATION means the deposition or accumulation of sediment.

SITE means a lot or parcel of land, or a contiguous combination thereof, where grading work is performed as a single unified operation.

SITE DEVELOPMENT means altering terrain and/or vegetation and constructing improvements.

SITE DEVELOPMENT PERMIT means a permit issued by the District for the construction or alteration of ground improvements and structures for the control of erosion, runoff, and grading.

STRIPPING means any activity which removes the vegetative surface cover including tree removal, clearing, and storage or removal of topsoil.

VACANT means land on which there are no structures or only structures which are secondary to the use or maintenance of the land itself.

ARTICLE III GENERAL PRINCIPLES

It is the objective of this ordinance to control soil erosion and sedimentation caused by development activities in the District. Measures taken to control erosion and sedimentation should be adequate to assure that sediment is not transported from the site by a storm event of ten-year frequency or less. The following principles shall apply to all development activities within the District and to the preparation of the submissions required under Article IV of this ordinance.

1. Development should be related to the topography and soils of the site so as to create the least potential for erosion. Areas of steep slopes where high cuts and fills may be required should be avoided wherever possible, and natural contours should be followed as closely as possible.
2. Natural vegetation should be retained and protected wherever possible. Areas immediately adjacent to natural watercourses should be left undisturbed wherever possible.
3. The smallest practical area of land should be exposed for the shortest practical time during development.
4. Sediment basins, debris basins, desilting basins, or silt traps or filters should be installed and maintained to remove sediment from runoff waters from land undergoing development.

5. The selection of erosion and sedimentation control measures should be based on assessment of the probable frequency of climatic and other events likely to contribute to erosion, and on evaluation of the risks, costs, and benefits involved.

6. In the design of erosion control facilities and practices, aesthetics and the requirements of continuing maintenance should be considered.

7. Provisions should be made to accommodate the increased runoff caused by changed soil and surface conditions during and after development. Drainageways should be designed so that their final gradients and the resultant velocities of discharges will not create additional erosion.

8. Permanent vegetation and structures should be installed as soon as practical during development.

ARTICLE IV SITE DEVELOPMENT PERMIT

A. Permit Required

In each instance that an owner or developer of real estate is required to obtain subdivision plat approval from the Porter County Plan Commission, said owner or developer of real estate must also obtain a site development permit from the Valparaiso Lakes Area Conservancy District.

B. Exceptions

Even in those instances where a site development permit is not required under Article IV, Section A of this ordinance, no person shall commence or perform any grading, stripping, excavating, or filling of land without complying with the applicable standards and requirements for control of soil erosion and sedimentation as contained in Article V of this ordinance, as well as implement necessary erosion and sedimentation control measures to satisfy the general principles contained in Article III of this Ordinance.

A permit shall not be required for any of the following:

1. Development of a site of less than 1 acre upon which no more than 1 residential structure is to be built, or of less than $\frac{1}{2}$ acre upon which no more than 1 commercial or industrial structure is to be built; provided that the person responsible for any such development shall implement necessary erosion and sedimentation control measures to satisfy the principles set forth in Article III of this ordinance, and the Conservancy District reserves the right to require such site development techniques as will insure satisfactory erosion and sedimentation control at such locations;

2. Agricultural use of land, including the implementation of conservation measures included in a farm conservation plan approved by the Soil and Water Conservation District, and including the construction of agricultural structures;

3. Installation, renovation, or replacement of a sewer line, waterline, or septic system to serve an existing dwelling or structure pursuant to the prior approval of same by the Porter County Board of Health.

C. Application for Permit

Application for a site development permit shall be made by the owner of the property or his authorized agent to the Valparaiso Lakes Area Conservancy District on a form furnished for that purpose. Each application shall bear the name(s) and address(es) of the owner or developer of the site and of any consulting firm retained by the applicant together with the name of the applicant's principal contact at such firm, and shall be accompanied by a filing fee of one hundred (\$100) dollars. Each application shall include certification that any land clearing, construction, or development involving the movement of earth shall be in accordance with the plans approved upon issuance of the permit.

D. Submissions

Each application for a site development permit shall be accompanied by the following information:

1. A vicinity map in sufficient detail to enable easy location in the field of the site for which the permit is sought, and including the boundary line and approximate acreage of the site, existing zoning, and a legend and scale.

2. A development plan of the site showing:

- a. Existing topography of the site and adjacent land within approximately 100 feet of the boundaries, drawn at no greater than two-foot contour intervals and clearly portraying the conformation and drainage pattern of the area.
- b. The location of the existing buildings, structures, utilities, water bodies, flood plains, drainage facilities, vegetative cover, paved areas, and other significant natural or man-made features on the site and adjacent land within approximately 100 feet of the boundary.
- c. A general description of the predominant soil types on the site, their location, and their limitations for the proposed use.

- d. Proposed use of the site, including present development and planned utilization; areas of excavation, grading, and filling; proposed contours, finished grades, and street profiles; provisions for storm drainage, including the control of accelerated runoff, with a drainage area map and computations; kinds and locations of utilities; and areas and acreages proposed to be paved, covered, sodded or seeded, vegetatively stabilized, or left undisturbed.

3. An erosion and sedimentation control plan showing:

- a. All erosion and sedimentation control measures necessary to meet the objectives of this ordinance throughout all phases of construction and permanently after completion of development of the site.
- b. Seeding mixtures and rates, types of sod, method of seedbed preparation, expected seeding dates, type and rate of lime and fertilizer application, and kind and quantity of mulching for both temporary and permanent vegetative control measures.
- c. Provisions for maintenance of control facilities, including easements and estimates of the cost of maintenance.
- d. Identification of the person(s) or entity which will have legal responsibility for maintenance of erosion control structures and measures after development is completed.

4. The proposed phasing of development of the site, including stripping and clearing, rough grading and construction, and final grading and landscaping. Phasing should identify the expected date on which clearing will begin, the estimated duration of exposure of cleared areas, and the sequence of clearing, installation of temporary sediment control measures, installation of storm drainage, paving streets and parking areas, and establishment of permanent vegetative cover.

These submissions shall be prepared in accordance with the standards and requirements contained in the "Procedures and Standards for Urban Soil Erosion and Sedimentation Control" as prepared, adopted, and approved and from time to time amended by the Board of Directors of the Valparaiso Lakes Area Conservancy District, which standards and requirements are hereby incorporated into this ordinance by reference.

The Conservancy District may waive specific requirements for the content of submissions upon finding that the information submitted is sufficient to show that the work will comply with the objectives and principles of this ordinance.

E. Bonds

The applicant may be required to file with the Conservancy District a faithful performance bond or bonds, letter of credit, or other improvement security satisfactory to the Board of Directors of the Conservancy District in an amount deemed sufficient by the Board of Directors of the Conservancy District to cover all costs of improvements, landscaping, maintenance of improvements and landscaping for such period as specified by the Board of Directors of the Conservancy District, and engineering and inspection costs to cover the cost of failure or repair of improvements installed on the site.

F. Review and Approval

Each application for a site development permit shall be reviewed and acted upon according to the following procedures:

1. The Conservancy District Engineer shall review each application for a site development permit to determine its conformance with the provisions of this ordinance. Within (45) days after receiving an application, the Chairman of the Board of Directors of the Conservancy District shall upon the recommendation and advice of the District Engineer make one of the following findings in writing, (a) approve the permit application if it is found to be in conformance with the provisions of this ordinance, and issue the permit; (b) approve the permit application subject to such reasonable conditions as may be necessary to secure substantially the objectives of this ordinance, and issue the permit subject to these conditions; or (c) disapprove the permit application, indicating the deficiencies and the procedure for submitting a revised application and/or submission.

2. No site development permit shall be issued for an intended development site unless:

- a. The development, including but not limited to subdivisions and planned unit development, has been approved by the Conservancy District where applicable, or
- b. Such permit is accompanied by or combined with a valid building permit issued by the Conservancy District, or
- c. The proposed earth moving is coordinated with any overall development program perviously approved by the Conservancy District for the area in which the site is situated.

3. Failure of the Chairman of the Board of Directors of the Conservancy District to act on the original or revised application within forty-five (45) days of receipt shall authorize the applicant to proceed in accordance with the plans as filed unless such time is extended by agreement between the Chairman of the Board of Directors of the Conservancy District and the applicant. Pending preparation and approval of a revised plan, development activities shall be allowed to proceed in accordance with conditions established by the Board of Directors of the Conservancy District.

G. Appeals

The applicant, or any person or agency which receives notice of the filing of the application, may appeal the decision of the Chairman of the Board of Directors as provided in paragraph F(3) of this Article IV, to the Full Board of Directors of the Conservancy District. Upon receipt of an appeal, the Full Board of Directors of the Conservancy District shall schedule and hold a public hearing, after giving 15 days' notice thereof. The Board of Directors of the Conservancy District shall give such notice of such public hearing as it deems necessary and appropriate. The Board of Directors of the Conservancy District shall hear evidence at such hearing and render a decision within thirty (30) days after the hearing. Factors to be considered on review shall include, but need not be limited to, the effects of the proposed development activities on the surface water flow to tributary and downstream lands, any comprehensive watershed management plans, or the use of any retention facilities; possible situation of fill and unsupported cuts by water, both natural and domestic; runoff surface waters that produce erosion and silting of drainageways; nature and type of soil or rock which when disturbed by the proposed development activities may create earth movement and produce slopes that cannot be landscaped; and excessive and unnecessary scarring of the natural landscape through grading or removal of vegetation.

H. Retention of Plans

Plans, specifications, and reports for all site developments shall be retained in original form or on microfilm by the Conservancy District.

ARTICLE V OPERATION STANDARDS AND REQUIREMENTS

A. Applicability

All grading, stripping, excavating, and filling which is subject to the permit requirements of this ordinance, and any grading, stripping, excavating, and filling which is exempted from the permit requirement by paragraph B(1) of Article IV, shall be subject to the applicable standards and requirements set forth in this Article V.

B. Responsibility

The permittee shall not be relieved of responsibility for damage to persons or property otherwise imposed by law, and the Conservancy District or its officers or agents will not be made liable for such damage, by (1) the issuance of a permit under this ordinance, (2) compliance with the provisions of that permit or with conditions attached to it by the Conservancy District, (3) failure of the Conservancy District officials to observe or recognize hazardous or

unsightly conditions, (4) failure of Conservancy District officials to recommend denial of or to deny a permit, or (5) exemptions from the permit requirements of this ordinance.

C. Procedures and Standards Adopted by Reference

The standards and specifications contained in the "Procedures and Standards for Urban Soil Erosion and Sedimentation Control", cited in paragraph D of Article IV, are hereby incorporated into Article V and made a part hereof by reference for the purpose of delineating procedures and methods for operation under site development and erosion and sedimentation control plans approved under Article IV and as the standard and guideline to be utilized by any person engaged in any grading, stripping, excavating, or filling of land within the boundaries of the Conservancy District. In the event of conflict between provisions of said manual and of this ordinance, the ordinance shall govern.

D. Inspection

The Conservancy District shall make inspections as hereinafter required and shall either approve that portion of the work completed or shall notify the permittee wherein the work fails to comply with the site development or erosion or sedimentation control plan as approved. Plans for grading, stripping, excavating, and filling work bearing the stamp of approval of the Conservancy District shall be maintained at the site during progress of the work. In order to obtain inspections, the permittee shall notify the Conservancy District at least two (2) working days before the completion of:

1. Stripping and clearing,
2. Rough grading,
3. Final grading,
4. Final Landscaping.

If stripping, clearing, grading and/or landscaping are to be done in phases or areas, the permittee shall give notice and request inspection at the completion of each of the above work stages in each phase or area. If an inspection is not made and notification of the results given within five working days after notice is received by the Conservancy District from the permittee, the permittee may continue work at his own risk, without presuming acceptance by the Conservancy District. Notification of the results of the inspection shall be given in writing at the site.

E. Special Precautions

1. If at any stage of the grading of any development site the Conservancy District determines by inspection that the nature of the site is such that further work authorized by an existing permit is likely to imperil any property, public way, watercourse or drainage structure, the Conservancy District may require, as a condition of allowing the work to be done, that such reasonable special precautions to be taken as is considered advisable to avoid the likelihood of such peril. "Special precautions" may include, but shall not be limited to, a more level exposed slope, construction of additional drainage facilities, berms, terracing, compaction, or cribbing, installation of plant materials for erosion control, and recommendations of a registered soils engineer and/or engineering geologist which may be made requirements for further work.

2. Where it appears that storm damage may result because the grading on any development site is not complete, work may be stopped and the permittee required to install temporary structures or take such other measures as may be required to protect adjoining property or the public safety. On large developments or where unusual site conditions prevail, the Conservancy District may specify the time of starting grading and time of completion or may require that the operations be conducted in specific stages so as to insure completion of protective measures or devices prior to the advent of seasonal rains.

F. Amendment of Plans

Major amendments of the site development or erosion and sedimentation control plans shall be submitted to the Conservancy District Engineer and shall be processed and approved or disapproved in the same manner as the original plans. Field modifications of a minor nature may be authorized by the Conservancy District Engineer by written authorization to the permittee.

G. Expiration of Permit

Every site development permit shall expire and become null and void if the work authorized by such permit has not been commenced within one hundred and eighty (180) days, or is not completed by a date which shall be specified in the permit; except that the Conservancy District may, if the permittee presents satisfactory evidence that unusual difficulties have prevented work being commenced or completed within the specified time limits, grant a reasonable extension of time if written application is made before the expiration date of the permit.

ARTICLE VI ENFORCEMENT

A. Exceptions

The Board of Directors of the Conservancy District may, in accordance with the following procedures, authorize exceptions to any of the requirements and regulations set forth in this ordinance:

1. Application for any exception shall be made by a verified petition of the applicant for a site development permit, stating fully the grounds of the petition and the facts relied upon by the applicant. Such petition shall be filed with the site development permit application. In order for the petition to be granted, it shall be necessary that the Board of Directors of the Conservancy District find all of the following facts with respect to the land referred to in the petition:

- a. That the land is of such shape and size or is affected by such physical conditions or is subject to such title limitations of record that it is impossible or impractical for the applicant to comply with all of the requirements of this ordinance;
- b. That the exception is necessary for the preservation and enjoyment of a substantial property right of the applicant; and
- c. That the granting of the exception will not be detrimental to the public welfare or injurious to other property in the vicinity of the subject property.

2. Each application for an exception shall be referred to the Conservancy District Engineer for review. The Conservancy District Engineer shall transmit his recommendation to the Board of Directors of the Conservancy District, which shall review such recommendations prior to the granting or denying of the exception.

3. The Board of Directors of the Conservancy District shall hold a public hearing on each application for exception, within thirty (30) days after receiving application, in the manner provided with respect to appeals. After public hearing, the Board of Directors of the Conservancy District may approve the site development permit application with the exceptions and conditions it deems necessary or it may disapprove such site development permit application and exception application or it may take such other action as deemed appropriate.

B. Stop-Work Order; Revocation of Permit

In the event any person holding a site development permit pursuant to this ordinance violates the terms of the permit, or carries on site development in such a manner as to materially adversely affect the health, welfare, or safety of persons residing or working in the

neighborhood of the development site or so as to be materially detrimental to the public welfare or injurious to property or improvements in the neighborhood, the Chairman of the Board of Directors of the Conservancy District or his authorized representative may suspend or revoke the site development permit.

1. Suspension of a permit shall be by a written stop-work order issued by the Chairman of the Board of Directors of the Conservancy District or his authorized representative and delivered to the permittee or his agent or the person performing the work. The stop-work order shall be effective immediately, shall state the specific violations cited, and shall state the conditions under which work may be resumed. A stop-work order shall remain in effect until the next regularly scheduled meeting of the Board of Directors of the Conservancy District at which the conditions of sub-paragraph 2 below can be met.

2. No site development permit shall be permanently suspended or revoked until a hearing is held by the Board of Directors of the Conservancy District. Written notice of such hearing shall be served on the permittee, either personally or by registered mail, and shall state:

- a. the grounds for complaint or reasons for suspension or revocation, in clear and concise language;
- b. the time when and place where such hearing will be held.

Such notice shall be served on the permittee at least five (5) days prior to the date set for the hearing. At such hearing, the permittee shall be given an opportunity to be heard and may call witnesses and present evidence on his behalf. At the conclusion of the hearing the Board of Directors of the Conservancy District shall determine whether the permit shall be suspended or revoked.

C. Violations and Penalties

No person shall construct, enlarge, alter, repair, or maintain any grading, excavation or fill, or cause the same to be done, contrary to or in violation of any terms of this ordinance. Any person violating any of the provisions of this ordinance shall be deemed guilty of a misdemeanor, and each day during which any violation of any of the provisions of this ordinance is committed, continued, or permitted shall constitute a separate offense. Upon conviction of any such violation, such person, partnership or corporation shall be punished by a fine of not more than (\$500) for each offense. In addition to any other penalty authorized by this section, any person, partnership, or corporation convicted of violating any of the provisions of this ordinance shall be required to restore the site to the condition existing prior to commission of the violation, or to bear the expense of such restoration.

This ordinance having been adopted and implemented by the Board of Directors of the Valparaiso Lakes Area Conservancy District this 21st day of September, 1988.

Frank Fausdowne
Member, Board of Directors

John P. Mooney
Member, Board of Directors

G. S. Mac Douane
Member, Board of Directors

Paul E. Beck
Member, Board of Directors

Bernie Hunter
Member, Board of Directors

Gustav Gustafson
Member, Board of Directors

Exhibits 3, 4, 5, and 6 are large engineering maps that are not scanned.

Exhibit 7 – Laboratory Report Dated November 1, 1988.



Telephone (219) 464-2389

2400 Cumberland Drive
Valparaiso, Indiana 46383

CLIENT PTGR, Inc. DATE November 1, 1988

ATTENTION Mr. Ordell Gertsmeier PHONE 462-1158

ADDRESS 158 S. Napoleon, Valparaiso, IN 46383 DATE OF SAMPLE RECEIPT

SAMPLE COLLECTED BY NLE Personnel October 17, 1988 (3595)

PARAMETER	SAMPLE LOCATIONS AND RESULTS (mg/L)			
	1** 10:30 am 10-17-88	2** 10:30 am 10-17-88	3** 10:30 am 10-17-88	4** 10:30 am 10-17-88
pH	7.9	7.7	7.5	7.5
BOD	<2.0	<2.0	<2.0	<2.0
Total Suspended Solids	<2.5	<2.5	<2.5	<2.5
Grease & Oil	<2.0	4.8	3.3	2.9
Ammonia-Nitrogen	<0.10	<0.10	<0.10	<0.10
Nitrate-Nitrite	<0.03	<0.03	<0.03	<0.03
Total Phosphorus	0.02	0.02	0.01	0.03
Total-Kjeldahl-Nitrogen	1.2	0.79	0.93	0.85
Fecal Coliform	2/100 mL	10/100 mL	8/100 mL	7/100 mL

PARAMETER	SAMPLE LOCATIONS AND RESULTS (mg/L)			
	1** 12:00 pm 10-17-88	2** 12:00 pm 10-17-88	3** 12:00 pm 10-17-88	4** 12:00 pm 10-17-88
pH	7.6	7.4	7.2	7.4
BOD	<2.0	<2.0	<2.0	<2.0
Total Suspended Solids	<2.5	<2.5	<2.5	<2.5
Grease & Oil	4.3	2.4	3.7	2.4
Ammonia-Nitrogen	<0.10	<0.10	<0.10	<0.10
Nitrate-Nitrite	<0.03	<0.03	<0.03	<0.03
Total Phosphorus	0.02	0.02	0.02	0.02
Total-Kjeldahl-Nitrogen	0.78	0.79	0.75	0.67
Fecal Coliform	10/100 mL	5/100 mL	6/100 mL	<100 - >50/100 mL

*See attached map for sampling sites

CONTINUED ON NEXT PAGE

**NORTHERN LABORATORIES AND
ENGINEERING, INC.**

ENVIRONMENTAL CONSULTING AND TESTING
AIR & WATER POLLUTION-SOLID WASTES SAMPLING - ANALYSIS - CONSULTING

Telephone (219) 464-2389 FAX: 219-462-2953

2400 Cumberland Drive
Valparaiso, Indiana 46383

LABORATORY REPORT

CLIENT PTGR, Inc. DATE November 1, 1988

ATTENTION Mr. Ordell Gertsmeier PHONE 462-1158

ADDRESS 158 S. Napoleon, Valparaiso, IN 46383 DATE OF SAMPLE RECEIPT

SAMPLE COLLECTED BY NLE Personnel October 17, 1988 (3595)

PARAMETER	SAMPLE LOCATIONS AND RESULTS (mg/L)			
	1	*2*	*3*	*4*
	9:00 am	9:00 am	9:00 am	9:00 am
	<u>10-18-88</u>	<u>10-18-88</u>	<u>10-18-88</u>	<u>10-18-88</u>
pH	7.7	7.2	7.5	7.2
BOD	<2.0	<2.0	<2.0	<2.0
Total Suspended Solids	33	<2.5	<2.5	2.5
Grease & Oil	5.1	4.5	4.4	<2.0
Ammonia-Nitrogen	0.15	<0.10	<0.10	<0.10
Nitrate-Nitrite	0.80	<0.03	<0.03	<0.03
Total Phosphorus	0.10	0.02	0.02	0.02
Total-Kjeldahl-Nitrogen	0.91	0.51	0.65	0.78
Fecal Coliform	>6000/100 mL	400/100 mL	100/100 mL	200/100 mL

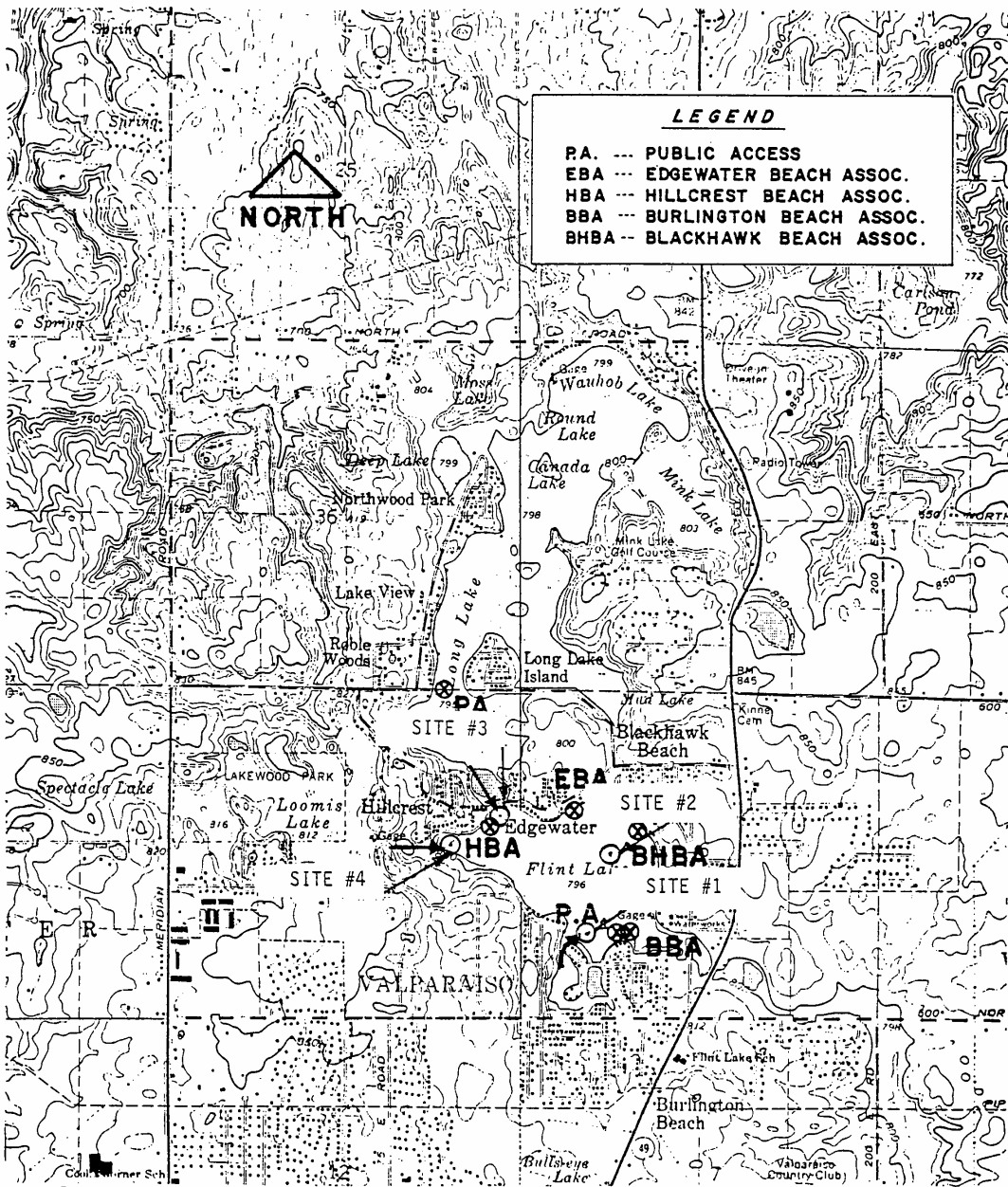
	"1"x	"2"x	"3"x	"4"x
	11:00 am	11:00 am	11:00 am	11:00 am
	<u>10-18-88</u>	<u>10-18-88</u>	<u>10-18-88</u>	<u>10-18-88</u>
pH	7.4	7.5	7.7	7.5
BOD	<2.0	<2.0	<2.0	2.1
Total Suspended Solids	15	<2.5	<2.5	13
Grease & Oil	4.2	6.5	3.9	4.4
Ammonia-Nitrogen	0.15	<0.10	<0.10	0.11
Nitrate-Nitrite	0.37	<0.03	<0.03	0.06
Total Phosphorus	0.06	0.02	0.02	0.04
Total-Kjeldahl-Nitrogen	0.91	0.90	0.67	0.85
Fecal Coliform	1500/100 mL	600/100 mL	19/100 mL	100/100 mL

*See attached map for sampling sites

baw/ptqr

Approved by Ron Arnold
Manager of Analytical Chemistry Section

SAMPLING SITE LOCATIONS



FLINT LAKE ACCESS MAP

Prepared by:
PTGR, Inc.
158 S. Napoleon Street
Valparaiso, IN 46383

Northern Labs & Engineering, Inc.
2400 Cumberland Drive
Valparaiso, IN 46383

Exhibit 8: Laboratory Report Dated
December 5, 1988.



**NORTHERN LABORATORIES AND
ENGINEERING, INC.**

ENVIRONMENTAL CONSULTING AND TESTING
AIR & WATER POLLUTION-SOLID WASTES SAMPLING - ANALYSIS - CONSULTING

Telephone (219) 464-2389 FAX: 219-462-2953

2400 Cumberland Drive
Valparaiso, Indiana 46383

LABORATORY REPORT

CLIENT PTGR, Inc. DATE December 5, 1988
ATTENTION Mr. Ordell Gertsmeier PHONE 462-1158
ADDRESS 158 South Napoleon Street, Valparaiso, IN 46383 DATE OF SAMPLE RECEIPT
SAMPLE COLLECTED BY Northern Labs & Engineering November 15, 1988 (4046)

PARAMETER

RESULTS

	11-15-88	11-15-88
	<u>Long Lake Influent</u>	<u>Loomis Lake Influent</u>
pH	7.0	7.3
BOD	2.6	5.5
Total Suspended Solids	<2.5	7.0
Grease & Oil	2.5	3.0
Ammonia-Nitrogen	<0.10	<0.10
Nitrate-Nitrite-Nitrogen	0.06	0.14
Total Phosphorus	0.05	0.07
Total-Kjeldahl-Nitrogen	1.24	1.17
Fecal Coliform	200/100 mL	4/100 mL

All results reported in mg/L unless otherwise noted

baw/lab

Approved by

Ron Arnold

Manager of Analytical Chemistry Section

Exhibit 9: Eutrophication tables.

Exhibits 10, 11 are large engineering drawings and are not scanned.

Table I

Parameter Ranges and Eutrophy Points for
Evaluation of Eutrophication Index

Parameter and Range		Eutrophy Points
I.	Total Phosphorus (mg/L)	
	A. At least 0.03	1
	B. 0.04 to 0.05	2
	C. 0.06 to 0.19	3
	D. 0.2 to 0.99	4
	E. 1.0 or more	5
II.	Soluble Phosphorus (mg/L)	
	A. At least 0.03	1
	B. 0.04 to 0.05	2
	C. 0.06 to 0.19	3
	D. 0.2 to 0.99	4
	E. 1.0 or more	5
III.	Organic Nitrogen (mg/L)	
	A. At least 0.5	1
	B. 0.6 to 0.8	2
	C. 0.9 to 1.9	3
	D. 2.0 or more	4
IV.	Nitrate (mg/L)	
	A. At least 0.3	1
	B. 0.4 to 0.8	2
	C. 0.9 to 1.9	3
	D. 2.0 or more	4
V.	Ammonia (mg/L)	
	A. At least 0.3	1
	B. 0.4 to 0.5	2
	C. 0.6 to 0.9	3
	D. 1.0 or more	4
VI.	Dissolved Oxygen	
	Percent Saturation at 5 feet from surface	
	A. 114% or less	0
	B. 115% to 119%	1
	C. 120% to 129%	2
	D. 130% to 149%	3
	E. 150 or more	4

Table I
(continued)

Parameter Ranges and Eutrophy Points for
Evaluation of Eutrophication Index

Parameter and Range		Eutrophy Points
VII.	Dissolved Oxygen	
	Percent of measured water column with at least 0.1 mg/L dissolved oxygen	
A.	28% or less	4
B.	29% to 49%	3
C.	50% to 65%	2
D.	66% to 75%	1
E.	76% to 100%	0
VIII.	Light Penetration	
	Secchi Disc	
A.	Five feet or under	6
IX.	Light Transmission	
	Photocell	
	Percent of light transmission at a depth of 3 feet	
A.	0 to 30%	4
B.	31% to 50%	3
C.	51% to 70%	2
D.	71% and up	0
X.	Total Plankton per mL	
	<u>One vertical tow from a depth of 5 feet</u>	
A.	Less than 500/mL	0
B.	500 to 1,000/mL	1
C.	1,000 to 2,000/mL	2
D.	2,000 to 3,000/mL	3
E.	3,000 to 6,000/mL	4
F.	6,000 to 10,000/mL	5
G.	More than 10,000/mL	10
H.	Blue-Green dominance	5 additional points

Table I
(continued)

Parameter Ranges and Eutrophy Points for
Evaluation of Eutrophication Index

Parameter and Range	Eutrophy Points
One vertical tow from a depth of 5 feet that includes the beginning of the thermocline	
A. Less than 1,000/mL	0
B. 1,000 to 2,000/mL	1
C. 2,000 to 5,000/mL	2
D. 5,000 to 10,000/mL	3
E. 10,000 to 20,000/mL	4
F. 20,000 to 30,000/mL	5
G. 30,000 or more	10
H. Blue-Green dominance	5 additional points
I. Populations of 100,000 or more	5 additional points

Lake Classification

From the studies conducted by the State of Indiana, a total of 307 lakes were grouped into categories using the clustering procedure. Results of these studies are summarized in Table II.

Table II
A Summary of the Lake Groupings from
Cluster Analysis

	<u>Area</u> (acres)	<u>Mean Depth</u> (feet)	<u>Index</u>
Group I	3,060 - 3,180	17.5 - 22.0	16 - 20
Group II			
A	50 - 48	17.5 - 31.0	1 - 16
B	40 - 1,034	31.2 - 45.0	3 - 25
C	37 - 388	32.7 - 40.5	18 - 41
Group III	1,291 - 1,864	5.0 - 24.5	23 - 48

Table II
(continued)

A Summary of the Lake Groupings from
Cluster Analysis

	<u>Area</u> (acres)	<u>Mean Depth</u> (feet)	<u>Index</u>
Group IV			
A	26 - 385	2.0 - 7.3	50 - 65
B	25 - 326	7.9 - 20.0	50 - 75
C	150 - 575	5.0 - 14.0	62 - 75
D	31 - 562	21.0 - 31.1	46 - 67
Group V	30 - 414	5.5 - 15.7	2 - 18
Group VI			
A	25 - 421	15.0 - 27.0	13 - 39
B	228 - 282	24.7 - 26.9	38 - 39
C	802	20.7	31
Group VII			
A	25 - 828	5.0 - 13.2	18 - 37
B	28 - 551	12.2 - 19.6	27 - 54
C	25 - 424	5.5 - 14.4	33 - 46